

POPULAR SCIENCE

December

15¢

MONTHLY

Mechanics & Handicraft



SEE
PAGE
84

Stearley
Bate

New Goodrich Battery

SO POWERFUL IT STARTS 2 CARS AT THE SAME TIME *AT 10° BELOW ZERO!*



Look! These New Goodrich Glasstex Mats are so porous that you can blow smoke right through them!



Read How Miracle Glass Mats *DOUBLE* BATTERY LIFE!*

• If you're one of the millions who have to drive in cold winter weather—here's good news. It's all about the new Goodrich Glasstex Battery that is so powerful that not just one but TWO motors can be started from it at the same time at 10° below zero! Just imagine, then, how much faster this new Goodrich Battery will start *your* car in cold winter weather when it has only *one* motor to turn!

To keep vital power-producing material in the plates from being lost—Goodrich “packs” this battery with the unique glass mats. These miracle mats do “double duty” by holding this valuable material in the plates *twice as long*—by being so porous they allow a full, free flow of the battery acid. See your nearest Goodrich Tire and Battery Dealer or Goodrich Silvertown Store now about this guaranteed Goodrich Glasstex Battery.

*Proved by life tests made in accordance with specifications of The Society of Automotive Engineers.

THE B. F. GOODRICH CO.

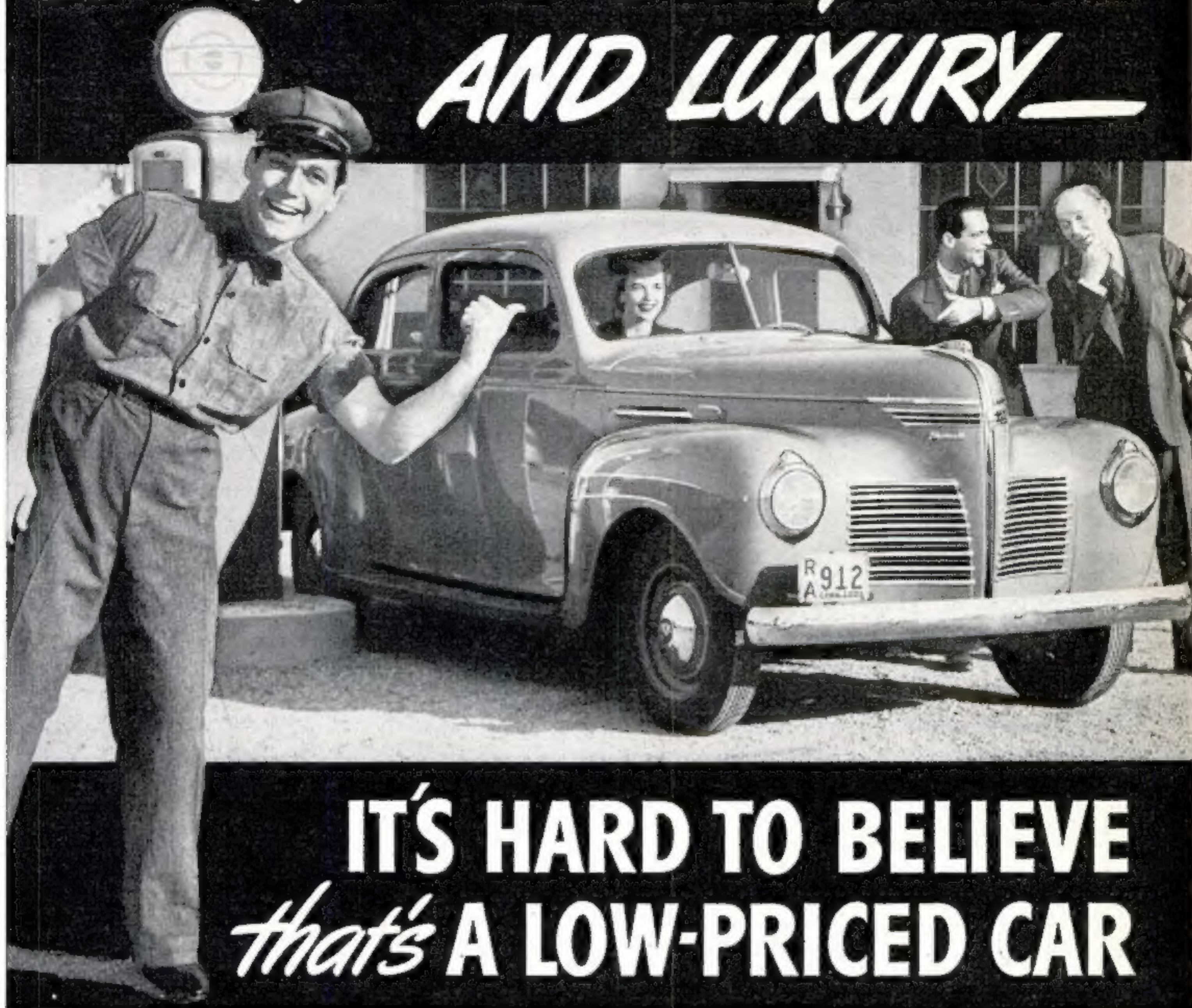
Akron, Ohio

Los Angeles, Calif.

Goodrich GLASSTEX Battery

Trade Mark Registered U. S. Patent Office

LOOK AT ITS SIZE, STYLE AND LUXURY



IT'S HARD TO BELIEVE *that's* A LOW-PRICED CAR

NEW LUXURY EVERYWHERE

1. **MAGNIFICENT STYLING**—new grace and distinction in every detail.
2. **BIGGER CAR** throughout — 117" wheelbase—wider seats!
3. **THE LUXURY RIDE!** New appointments, new chassis engineering—entirely new ride formula.

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There's a luxurious new feel to the big Floating Power engine—*Superfinished* in vital parts for longer life. Steering post gear shift, front coil springs are standard *on all models* ...new engineering, designing, throughout.

Be sure *you* take Plymouth's *Luxury Ride!*
MAJOR BOWES, C. B. S., THURSDAYS, 9 TO 10 P. M., E. S. T.
SEE THE NEW LOW-PRICED 1940 PLYMOUTH
COMMERCIAL PICK-UP AND PANEL DELIVERY!

1940 PLYMOUTH

*The Low-Priced Beauty
with the LUXURY RIDE*

POPULAR SCIENCE

Founded 1872

MONTHLY

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Mechanics & Handicraft

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CONTENTS FOR DECEMBER 1939

Forty Years of the Automobile.....	59
Boys Run "Sweet Potato" Factory.....	70
How Do You Get Along with People? ..	76
Gas Turbines Promise New Power Era ..	80
Television Planes Spy on Enemy.....	82
War in the Air.....	84
"Ghost" Voices Form Odd Collection ..	94
Night Prospecting—a New Hobby....	104
Cyclist Cheats Death with Gadgets....	108
Movies Help Train Our Soldiers.....	122
Bombing Forest Fires from the Air....	130
Drugs from Dog Hair.....	140

Features and Departments

OUR READERS SAY —	12
NEW IDEAS FOR HOME OWNERS	32
THE MAN WITH THE NET	133
POPULAR SCIENCE QUESTION BEE	150
UN-NATURAL HISTORY	151
GUS WILSON'S MODEL GARAGE	154
NATIONAL HOMEWORKSHOP GUILD	193
AMATEUR PHOTOGRAPHY	196
HOME-LABORATORY CHEMISTRY	202
ADVENTURES WITH YOUR MICROSCOPE	206
RADIO DEPARTMENT	212

AUTOMOBILES

Six-Story Garage in Skyscraper.....	73
Curb Feeler Aids Parking.....	119
Car Sponge Fits the Hand.....	133
Autographed Auto Tours Country.....	135
Truck Telltale Checks Driver.....	137
Chain Holds Key and License.....	147
Air Chamber Cushions Knocks.....	218
Wire Scale Gauges Map Distance.....	218
Homemade Socket Wrench.....	218
Reflector-Button "Dim" Sign.....	218
Wigwag Stop Signal.....	221
Paint Guards Brake Line.....	221
Wipes Snow off Car Roof.....	222
Driveway-Entrance Markers.....	222

AVIATION

Automatic Fire Extinguisher.....	101
Collectors Go for Airline Labels.....	102
New Aid for Seaplane Take-Off.....	112
Air-Raid Defense Headquarters.....	117
Homemade Oxygen Mask.....	119
Catapult Launches Target Plane.....	121
'Chute Pack Worn on Shoulders.....	138
Topsy-Turvy Stunt Plane.....	147

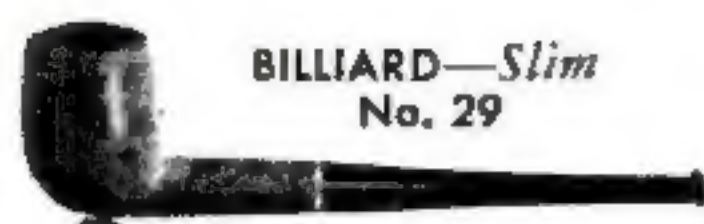
HEALTH AND HYGIENE

Ozone "Gun" Tones Up Skin.....	68
Babies Get Own "Apartments".....	100
Rigs Emergency Oxygen Apparatus....	116
Camera Dolly for Operating Room.....	118
Dental Lamp Clamps on Mouth.....	144
All-Metal Stretchers.....	144
Can Deadly Venom Save Lives?.....	146

(Continued on page 4)

THE HOME WORKSHOP begins on page 157

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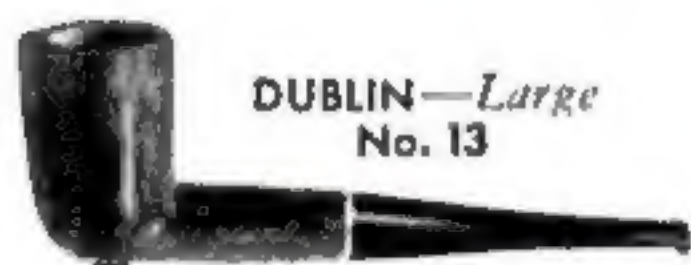
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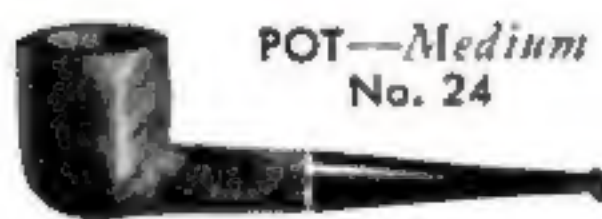
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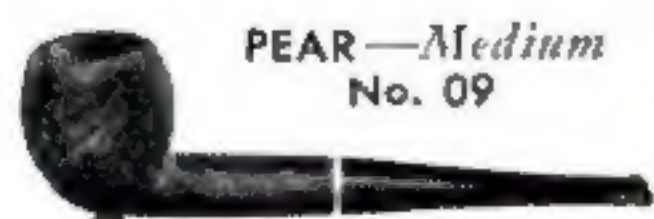
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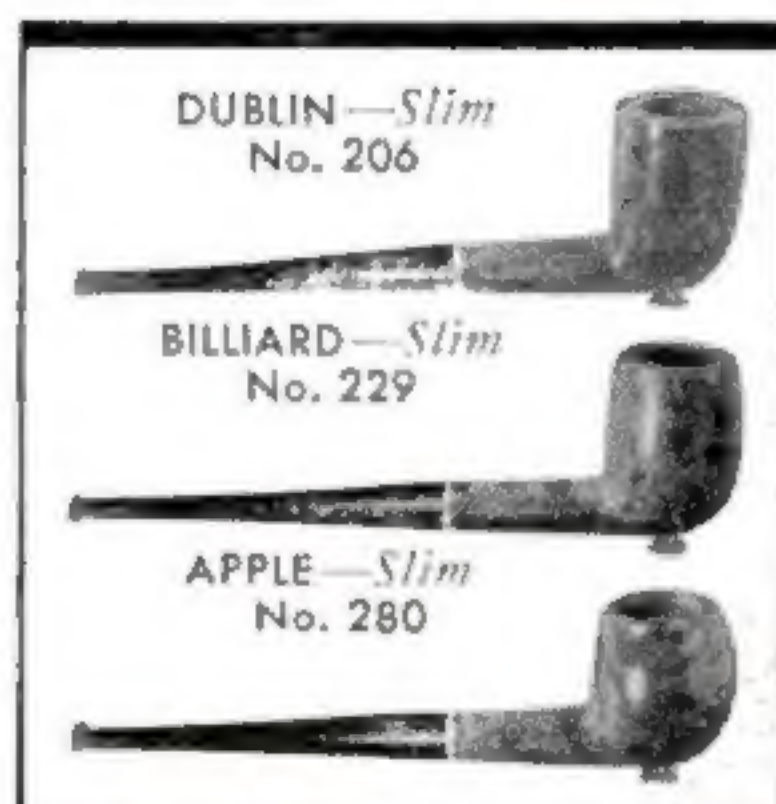
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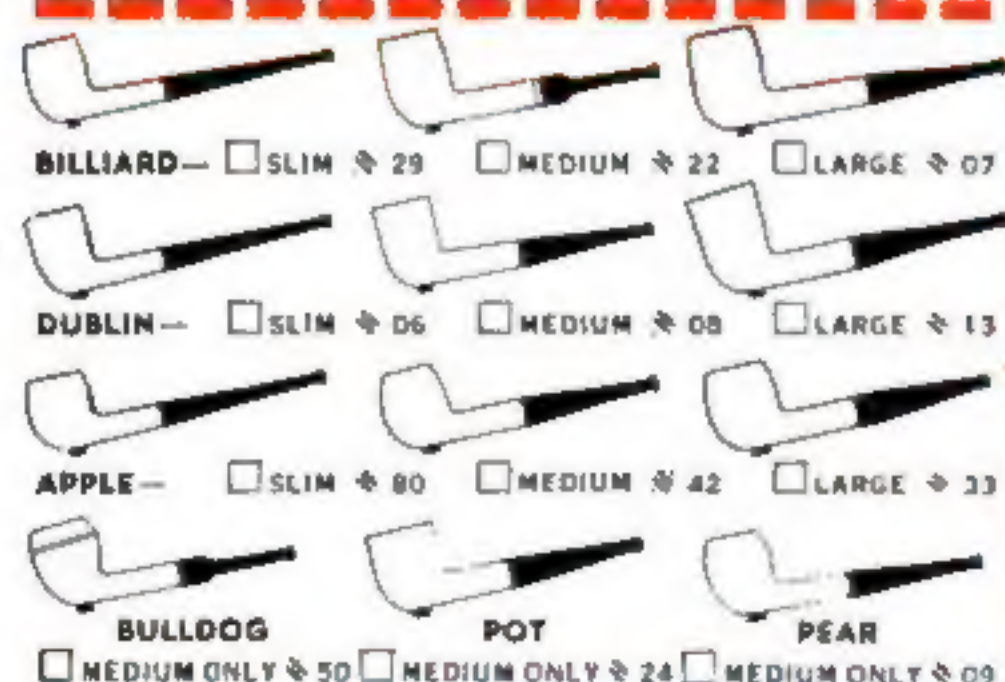
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CONTENTS [Continued]

HELPS FOR HOME OWNERS

Dustproof Light Socket.....	32
Handy Keyless Padlock.....	32
Stainless-Steel "Lumber".....	32
Solvent Loosens Finish.....	34
Rug Cleaner Retards Wear.....	34

HOUSEHOLD AIDS

Tightener for Clothesline.....	152
Cuts off Corn Kernels.....	152
Drink-Mixing Automat.....	152
Handy Kitchen Slicer.....	152
Snap-On Apron Has Spring.....	152
Ham-ers of Many Uses.....	153
Vitalizes Tap Water.....	153
Streamline Nutcracker.....	153
Suction-Cup Shelf Supporters.....	153

NEW INVENTIONS

Stoker Pipe for Smokers.....	64
Protractor Marks Line for Joint.....	64
Types Tunes Instead of Words.....	66
New Rotary Bins Save Time, Space....	67
Shoulder Shrug "Laces" Corset.....	67
New Electric Hand Tool.....	69
Quick-Change Chuck for Drills.....	72
Handy Funnel Fills Barrels.....	75
Clutch Works by Inflation.....	78
Clothespin Construction Kit.....	78
Switch Fires Starting Gun.....	89
Ear Guards for Factory Workers.....	90
Loader Speeds Rail-Truck Service.....	90
Mother Invents Walking Doll.....	91
Dock-to-Boat Communicator.....	97
Solve Puzzle and You Get a Penny.....	98
Practice Board for Table Tennis.....	99
Vacuum Cleaner Traps Scrap Metal....	100
Toy Bank Records Deposits.....	100
Cornstalk Cutter Frees Hands.....	101
Push-Button Pipe Wrench.....	113
Clamps Let Skiers Run Uphill.....	116
New Watermark Detector.....	117
Racing Game "Broadcasts" Results....	119
Shuffleboard on Small Table.....	120
Portable Torch Aids Firemen.....	120
Pocket Gauge for Speed of Wind.....	126
Cot Folds into Small Bundle.....	127
Barber's Aid Sucks Up Clipped Hair....	129
Three Face Masks in One.....	133
Elevator Speeds Fire Rescues.....	135
Man Bites Tender Hot Dog.....	137
Day or Night Light for Make-Up.....	138
Adapters Fit Many Electric Outlets....	144
Air Bomb Releases Advertisement.....	145
Cable Drill Clears Sewer Pipe.....	147

PHOTOGRAPHY

Post Card Frames Your Snapshot.....	72
120,000 Pictures a Second.....	74
Fan Gets Long-Distance Shot.....	97

Lamp-Bulb Drier for Prints.....	148
Hand Dynamo Fires Flash Bulbs.....	148
Tool Simplifies Film Splicing.....	148
Range Finder for Home Movies.....	149
Viewer Aids in Photo Composing.....	149
Handy Brush for Darkroom Use.....	149
Tripod Feet Grip Floor or Ground.....	149
Picture Data Recorded on Film.....	196
Printing Miniature Transparencies.....	196
Lighting Unit Built into Case.....	197
Photographic Greeting Cards.....	197
Line Drawing Made from a Print.....	197
Set-Up for Double Exposures.....	198
Causes of Milky Fixing Bath.....	198
Exposure Table for Daylight.....	198
Enlarging Corrects Distortion.....	199
Photoflood Exposure Guide.....	199
Developing Cut Film in Tank.....	252
How to Avoid Shutter Vibration.....	252
Fan Hastens Drying of Cement.....	255
Monohydrated Photo Chemicals.....	255
Photos Decorate Switch Plates.....	255

UNUSUAL FACTS AND IDEAS

"Electric Ears" Test Machines.....	64
How Radio Gathers the War News.....	65
Skull Adds to Lore on Ancient Man....	66
Fence Made of Auto Wheels.....	67
Broken Glass Is Good for Chicks.....	68
Fly on Egg Is Tape Measure.....	68
Cattle Crossings Get Telephones.....	69
Dials Speed Up Telegrams.....	72
Chart Keeps Murder-Case Record.....	75
He Beautifies "Bingo" Beans.....	75
Sunlight "Canned" for Shipment.....	79
Robot Guides Explain Brewery.....	79
Orchard on One Tree.....	88
Walking Microphone Boom.....	89
Fire Engine Crosses Country.....	90
Toy Village of Orange Crates.....	92
"Crime Map" Aids Police Head.....	92
Odd Problems of Polar Painter.....	93
Tattooing Chickens Foils Thieves.....	98
Sea-Bottom Post Office.....	99
Boys Plan Trip in P.S.M. Boat.....	101
New Chinese-Cross Puzzle.....	103
Aquarium Finds "Goldfish Mine".....	107
Rotating Library Aids Clerks.....	112
Purse Built into Cane.....	113
House of Clay and Car Parts.....	113
Real Rosebud Jewelry.....	114
Basement Business Yields Profits.....	114
Squeezes 144,000,000 Oranges a Year..	115
Study Films That Can't Be Seen.....	116
Silver Rustproofs Steel.....	117
Museum Gets Mammoth Skull.....	121
Ice Bike Puts Hockey on Wheels.....	127
Game Resembles Baseball and Golf....	128
Power-Plant Towers Camouflaged.....	129
"Mosquito Boats" of British Navy.....	132

(Continued on page 6)

The One BIG New Engineering Feature in the 1940 Cars!



NO GEARS TO SHIFT

NO CLUTCH TO PRESS

SAVES HALF THE EFFORT of DRIVING

ALL YOU DO TO DRIVE IS THIS YOU ELIMINATE

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SHIFTING

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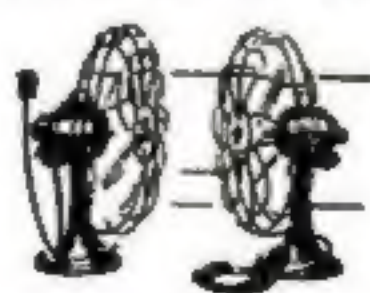
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BIGGEST
MONEY'S
WORTH**

HOW HE MARRIED HER WITHOUT A SCENT!



AL'S NEW CAR won Peg's fancy, but his new pipe got her nanny—it smelled fierce! So on went her roller skates to head for home. Wait! Here's the postman!



HE TOLD AL to clean his pipe, and re-filled it with mild Sir Walter. Peg stopped to sniff, stayed to snuggle. The fragrant burley blend *always* wins! Try a tin!

New!
CELLOPHANE
TAPE around lid
seals flavor in . . .
brings you tobacco
100% factory-fresh!



IT SMOKES AS SWEET AS IT SMELLS

TUNE IN—Sir Walter Raleigh "Dog House." Every Tuesday night, coast-to-coast, NBC Red Network.

CONTENTS [Continued]

Collars Test Crickets.....	133
If Tombstones Told the Truth.....	134
Takes Temperature a Mile Up.....	136
Barbers Furnish Holder for Glasses....	137
Seal Hunter Supplies Zoos.....	138
Famous Voyage Staged for Films.....	139
Bugs Flown to Work Here.....	144
Chart Tests Television Camera.....	146

CRAFTWORK

Charming Cape Cod Doll House.....	168
New Uses for Old Coat Hangers.....	176
Duck Moves Head When Pulled.....	178
Tray Gives Double Service.....	179
Bone Inlays Ornament Card Box.....	180
Dual-Purpose Lamp and Ash Tray.....	181
Rack Holds Spices or Crackers.....	182
Dough Tray Keeps Muffins Hot.....	182
Box Opens When Tail Is Pressed.....	183
Substitute for Blackboard Paint.....	183
Animals Adorn Napkin Rings.....	184
Squirrels Jump Beside Cart.....	184
Stationery Holder of Copper.....	185

HINTS FOR THE HANDY MAN

Steam Box Built from Oil Drums.....	167
Painted Suction Cups Match Walls.....	175
Jar Rings Support Lamp Cords.....	175
Flower Stands Bent from Rods.....	175
Small Snowplow Pushed Easily.....	177
Mounting a Heavy Lathe Chuck.....	177
Cork Disks for Small Gaskets.....	177
Rule Saves Time on Saw Work.....	192
Winding a Powerful Magnet.....	192
Spatter-Painted Xmas Cards.....	200

HOME LABORATORY

Chemical Analysis for Amateurs.....	202
Solution for Treating Burns.....	205
Microscope Questions and Answers....	206
Bulbs Show Resistance Laws.....	210
Model of Earth's Magnetism.....	210
Principle of Range Finders.....	210
Explanation of Specific Heat.....	211
Why Dirty Snow Melts Faster.....	211
Compass Swings Like Pendulum.....	211
Seeing Through a Picket Fence.....	211

MODELS

Realistic Model Railroad Crane.....	69
Pendulum Stabilizer for Plane.....	126
Amphibian Has Ten-Foot Wing Span	136
Small Clamps for Model Making.....	167
Building the Joe Lane—Part 2.....	188
Simplified Railway Switchboard.....	190

NEW SHOP IDEAS

Lathe Accessories You Can Make.....	170
Pouring Liquids from Square Cans.....	171
Hammer Punch for Light Work.....	172

(Continued on page 8)

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MORE THAN THREE THOUSAND APPLIED
FOR THOSE SIX JOBS.
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CONTENTS [Continued]

Wire Stand Supports Magnifier.....	172
Elastic Marks Triangular Scale.....	172
Fastening Drawings with Tape.....	173
Bearings Improve Steady Rest.....	173
Shop Sayings of Old Bill.....	234
Vacuum Cups Hold Bath Curtain.....	250
Draftless Window Ventilator.....	250
Bit Holder for Drill Press.....	257
Repairing Split Furniture Legs.....	257

RADIO

Floor-Lamp Radio Receiver.....	212
Trouble-Shooting for Amateurs.....	215
Amplifier Carried in Mike.....	216
Attachable Loop Antenna.....	216
Portable Recorder for Console.....	216
Resonators Control Tone.....	217
Pump Raises Car Antenna.....	217

SHOP DATA FILE

Workbench for Beginners.....	160
Brazing Narrow Band Saws.....	167
Carrying Capacity of Wires.....	173
Finishing Radiators and Pipes.....	177
How to Clean Paintbrushes.....	192
Daylight Exposure Table.....	198
Photoflood Exposure Guide.....	199

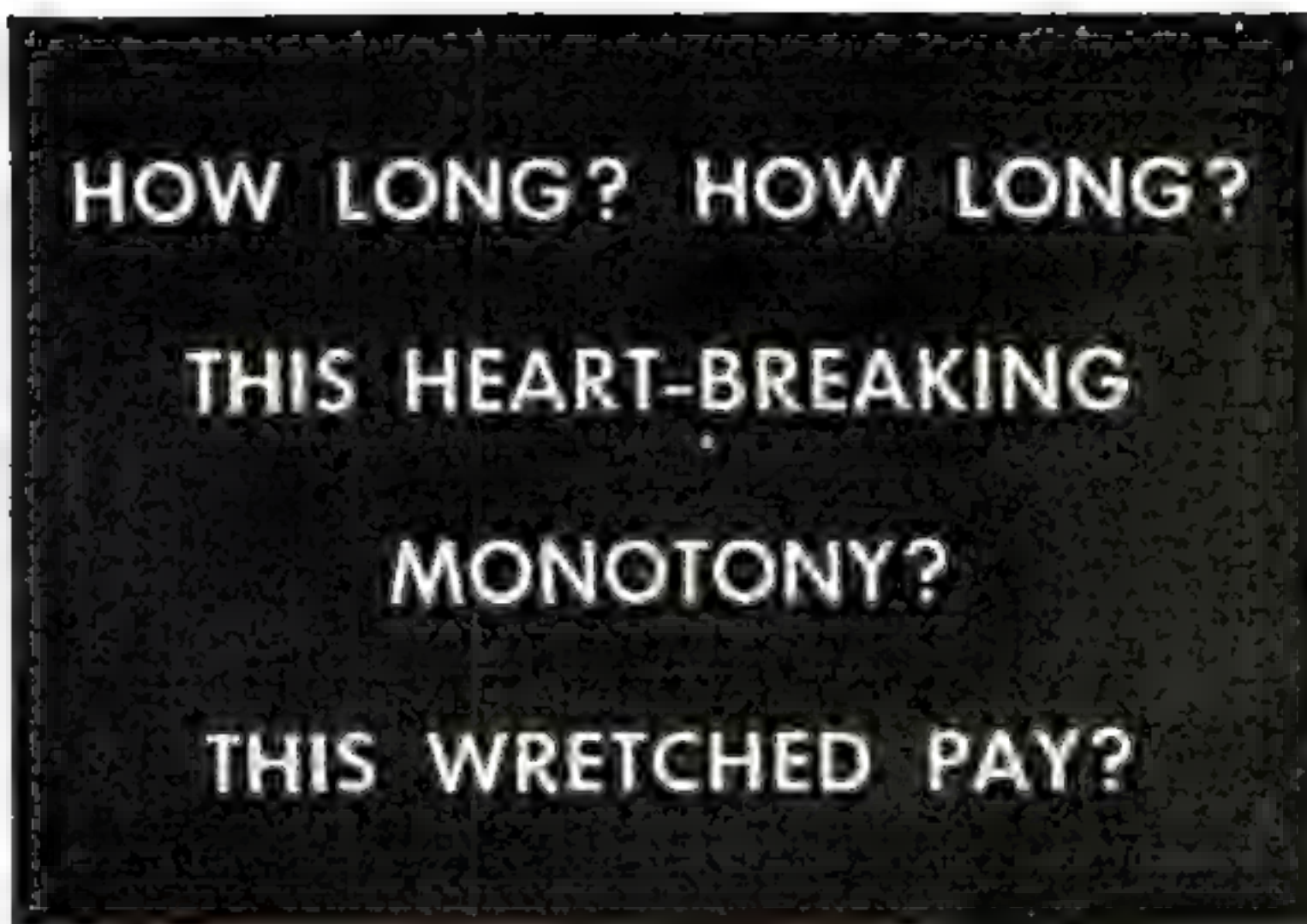
WOODWORKING

Why You Should Start a Workshop....	158
Ice Boat <i>Mercury</i> , 1940 Design.....	162
Hints on Planking Small Boats.....	174
Fireplace of Modern Design.....	186

NOW IS THE TIME TO Start a Home Workshop

How are you spending your spare time during the winter months? One of the best ways is in your workshop making projects for the home and to give to your family and friends. For the benefit of those who know little or nothing about a workshop, POPULAR SCIENCE MONTHLY is presenting a series of articles on the subject. "Why You Should Start a Home Workshop . . . And How to Do It" is this month's topic, which you will find on page 158.

In one of our home workshop articles Dan Beard, National Scout Commissioner of the Boy Scouts of America, once wrote, "With gumption a man can make almost anything." So if you have "gumption" and a genuine liking for tools, you can make a success of a home workshop . . . and you'll find it the finest hobby of all.



"If I Could Only Recover Those Ten Lost Years!"

[[The True Experience of a Man Who *Almost* Enrolled for LaSalle Home-Study Training]]

In December, 1921, an American employed with a mining firm in Mexico, clipped and signed a LaSalle advertisement coupon. *But he did not enroll!*

Ten years of silence followed . . . ten years of haphazard jobs, long hours, wretched pay . . .

Then, in January, *nineteen thirty two*, that silence was broken by a dramatic letter, high-spotted by these words: "Please send the first lessons with the least possible delay, as time is a highly important factor to me in this year of our Lord!"

Through five typewritten pages he recounted the hardships of those intervening years. A really able man, he had moved from one position to another, only to find advancement closed to him for lack of specialized training.

No need here to recite those hardships—though in justice to him it is only fair to say that on four separate occasions he had *almost* enrolled . . . and that on each occasion he had postponed action because of some unexpected reverse seemingly beyond his power to avoid.

"For five months now," so he wrote, "I have been 'on vacation.' Not a chance to take a course now—according to my carefully laid out and conscientiously followed program . . .

"But—supposing I had *chucked* that program at any time in the last 10 years? Supposing I had enrolled, in the face of seeming disaster, even though I had had to borrow the money to do it? Supposing even that I had enrolled only five months ago, at the beginning of my enforced vacation? In all likelihood I could have mastered the training by now. Or I might in the meanwhile have found a congenial and profitable position, thanks

to my increased knowledge. As it is, for all I know, there may be another five months without any position . . . with all sorts of dim prospects . . . and meanwhile I am getting older . . .

"*That settles it! To blaze with further procrastination! To thunderation with my financial program! I've borrowed the money, and I'll borrow some more . . . but I'll do something with my time! This year is going to see a big change in my affairs—and right here is where we start!*"

Send for Free Booklet

These are searching times—and wise is the man who takes full measure of his competition . . . gets the special training that he needs . . . and thus commands the unfolding opportunities of our new-day business world.

If you need to be *convinced* of those opportunities, forget that you ever read this message. For those opportunities are not for you . . .

But if you are determined to be out in front when men are picked for leadership one year, two years, ten years from now—do not, on your life, risk a day's delay.

Below is a coupon. It will bring you—without cost—books that have led to increased earnings running into many thousands of dollars! Men of action—*hundreds of them*—will use this coupon for their personal advancement. Be one of those men who will steadily win their way to the better-salaried positions.



Ask for one of these booklets—or a similar one on your own field of business. They are **FREE!**

LASALLE EXTENSION UNIVERSITY

A Correspondence Institution

Dept. 1283-R

Chicago, Illinois

I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

- | | | |
|--|--|--|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Law: Degree of LL. B. | <input type="checkbox"/> Business Correspondence |
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Expert Bookkeeping | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> C. P. A. Coaching | <input type="checkbox"/> Effective Speaking |
| <input type="checkbox"/> Modern Salesmanship | <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Stenotypy |
| <input type="checkbox"/> Commercial Law | <input type="checkbox"/> Modern Foremanship | |

Name _____ Age _____

Position _____ Address _____



Be a Radio

MANY MAKE \$30,

J. E. SMITH
President
National Radio
Institute
Est. 25 Years

**I will train you at home
for RADIO and TELEVISION**

I TRAINED THESE MEN

**\$10 TO \$20 A WEEK
IN SPARE TIME**



"I repaired many Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I have made an average of \$10 to \$20 a week—just spare time."—**JOHN JERRY**, 1529 Arapahoe St., Denver, Colo.

**OWNS SHOP, MAKES
\$3,000 A YEAR**

"Before taking your Course I earned about 17½ cents per hour as a truck driver. When I had completed 20 lessons I started service work. During the last year I have made about \$3,000 in Radio. I now own my own shop"—**KARL KELLY**, 306 W. Calhoun St., Magnolia, Ark.



**SALARY INCREASED \$1,800
YEAR IN RADIO**



"I have been regularly employed in radio since my graduation. I have been Chief Engineer of three broadcast stations and at present time am Chief Engineer of WDOD. My salary has increased \$1,800 per year since entering Radio and credit is given you for your excellent training."—**JULIUS C. VESSELS**, Station WDOD, Chattanooga, Tenn.

Radio is a young, growing field with a future. It offers you many good pay spare time and full time job opportunities. And you don't have to give up your present job, go away from home, or spend a lot of money to become a Radio Technician. I train you right at home in your spare time.

Jobs Like These Go To Men Who Know Radio

Radio broadcasting stations employ engineers, operators, technicians and pay well for trained men. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio; loud-speaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And my Course includes Television, which promises to open many good jobs soon.

Why Many Radio Technicians Make \$30, \$40, \$50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new



Set Servicing pays many Radio Technicians \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 extra a week in spare time.



Loud Speaker System building, installing, servicing and operating is another growing field for well trained Radio Technicians.

FIND OUT ABOUT THIS TESTED WAY

Technician

\$40, \$50 A WEEK

tubes, repairs, etc. Over 3,000,000 auto Radios are in use and thousands more are being sold every day. In every branch Radio is offering more opportunities—opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred \$30, \$40, \$50 a week jobs of 20 years ago have grown to thousands.

Many Make \$5 To \$10 a Week Extra In Spare Time While Learning

The day you enroll, in addition to my regular course, I start sending you Extra Money Job Sheets which start showing you how to do actual Radio repair jobs. Throughout your course I send plans and directions which have helped many make from \$200 to \$500 a year in spare time while learning.

You Get Practical Experience While Learning

I send you special Radio equipment; show you how to conduct experiments, build circuits illustrating important principles used in modern Radio and Television receivers, broadcasting station and loudspeaker installations. My 50-50 method of training gives you both printed and actual work with Radio parts—makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL ALL-WAVE RADIO SET SERVICING INSTRUMENT to help you make more money fixing Radio sets while learning and to equip you with a professional instrument for full time work after you graduate

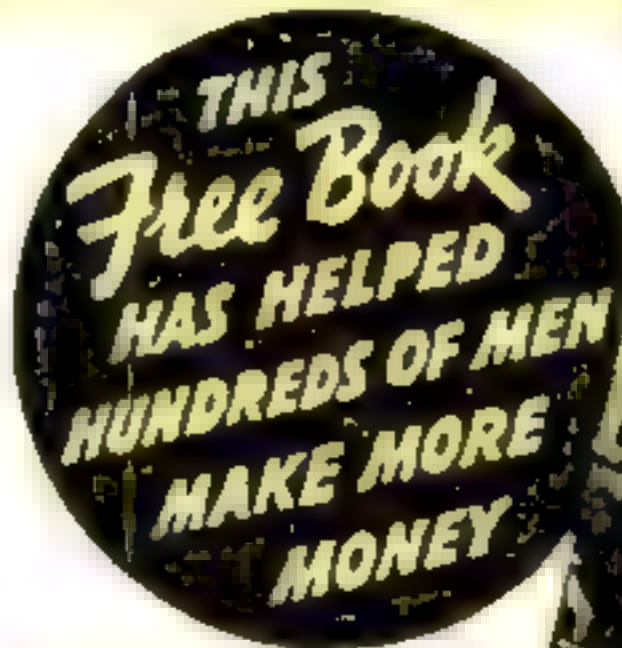


Broadcasting Stations employ operators, installation, maintenance men and Radio Technicians in other capacities and pay well.

Find Out What Radio Offers You

Act today. Mail coupon for my 64-page book, "Rich Rewards in Radio." It points out Radio's spare time and full time opportunities and those coming in Television; tells about my course in Radio and Television; shows many letters from men I trained, telling what they are doing and earning. Read my money back agreement. Find out what Radio offers you. Mail coupon in envelope or paste on a penny postcard—NOW.

J. E. SMITH, PRES., DEPT. 9NP3, NATIONAL RADIO INSTITUTE, WASHINGTON, D. C.



Mail this to get 64 page book FREE

J. E. Smith, President, Dept. 9NP3
National Radio Institute, Washington, D. C.

Dear Mr. Smith:

Send me FREE, without obligation, your 64-page book "Rich Rewards in Radio" which points out Radio's opportunities and tells how you train men at home to be Radio Technicians. (Write plainly.)

Name..... Age.....

Address

City..... State.....

Automobile Radio is another new Radio field—selling, installing, servicing. One million or more auto owners will install radio sets within the next year.

TO BETTER PAY

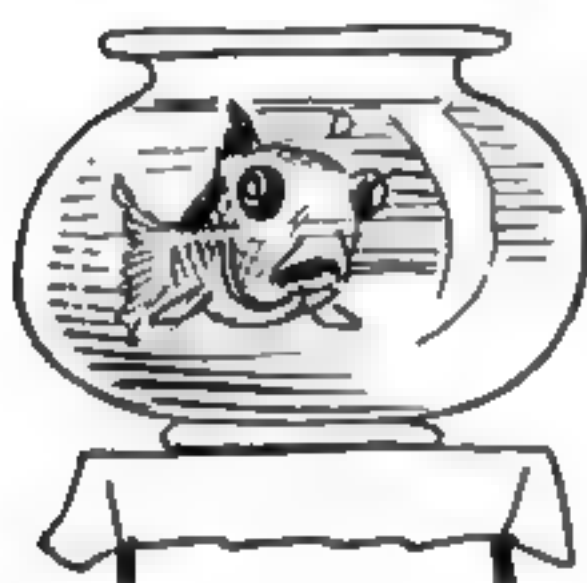
Our Readers Say



The Time May Come When We'll Have No Privacy at All

WELL, I took it in stride when "glass bricks" for building purposes first put a literal meaning in the old adage about "people who live in glass houses." Now I

NOW YOU KNOW HOW I'VE FELT ALL THESE YEARS!



hear that cars may be made with transparent-plastic tops. My heart goes out in pity for the modern youth and gal when cars no longer afford privacy consistent with the needs of those moments of "engine trouble." And what if the stuff is applied to airplanes? Can you imagine a pilot's body hurtling through air

with nothing but a motor in evidence? Or Lanky Joe doing a cocky bandmaster's step down Main Street on an invisible bicycle? Who knows but what we may even have transparent tires so we can see if there's enough air in them?—M. G., Brooklyn, N. Y.

Can a White Darkroom Be Dark, This Camera Fan Wants To Know

HAVING just finished building and painting a darkroom in my cellar, it now turns out that it's all wrong. At least, that is what a friend informs me who is a much older hand than I am at the photography game. Old hand or not, he's wrong, in my opinion. Here's the story. I knew, of course, that a darkroom should be dark. But I figured that if I made it light-tight and turned out the lights, it would be just that. Thinking that it would be a pretty gloomy place when the lights were on if I painted it dark, I made it

G'WAN, THE MOST WIDELY USED DARKROOM IS THE BATHROOM, AND THAT'S SHINY WHITE!



white—floor, walls, and ceiling. This, my friend says, will be bad when I'm working under red light with orthochromatic film, because the white surfaces will reflect the red light from the lamp, multiply its strength by reflection, and ruin my film. This scared me, so I've been working with the lights out—not a bad

idea in any case. Can anyone save me the trouble and expense of ruining a batch of good ortho film by telling me who's right, my friend or I? I still think it makes no

(Continued on page 14)

difference what color a darkroom is.—D. V., Toledo, Ohio.

Pretty Soon All We'll Need Is Standardized Drivers

FROM time to time your readers have recommended through their letters the standardization of automobile bumpers, lights, and so on. This year, for the first time, car manufacturers are beginning to standardize their headlight equipment so that the Whozis Six my neighbor drives and the Whatzis Special I buy gas for look exactly alike as they approach each other on a dark road at night. Drivers now can tell at once that the car approaching really is a car, and not two one-eyed cars, two motor cycles, one one-eyed car and the rising moon, or a pair of Japanese lanterns. On any given night we can now gauge with reasonable accuracy how far away a car is and how fast it is approaching, because we know from experience how its lights look as they approach. Now let's see the manufacturers standardize tail lights at a given brilliance, color, spacing, and height from the road. Why, one of the most serious of night-driving problems is practically licked!—M. A. M., San Francisco, Calif.

College Engineering Student Doffs His Freshman Hat to P. S. M.

WOULD like to tell you that I enjoy reading your magazine, and eagerly await the next issue. For my work as a college freshman in engineering, I find your magazine a great help in supplying information on current engineering problems. The "Home Workshop" section is also swell, and now that its size has been increased, I'm sure that the readers will enjoy it more than ever. —G. F. Z., North Bergen, N. J.

YOU'RE GOOD TOO, P.S.M.!



Ever See a Shadow Brighter Than the Surrounding Area?

PLAYING tennis last summer on a cloudy day, I noticed a queer thing that I'm at a loss to explain. The "shadow" from the net was brighter than the surrounding court. Per-

Training Counts in Every Field



You Must Know What to Do When Signals are Called

To play the game—whether on the football field or in the bigger jobs of business and industry—you must know what to do when the signals are called. To make the team a player must be above average—and you must be above average to meet the demands of employers for the better paid positions.

Your own ability to hold the better jobs depends entirely on the preparation you have made to accept the **opportunities offered every month in the year** in the active fields of today such as Air Conditioning, Diesel Engineering, Drafting and Design, etc. Men in these fields and others with preparation as accountants and in merchandising are being advanced into such openings as department heads, managers, foremen, superintendents, traveling auditors, etc.

Your opportunity today simply means being **ready** for the good jobs looking for good men—your chance for a worthwhile position depends on whether or not you will prepare to meet the demands of employers all over the country who are offering the big jobs to men who can handle them!

Without training a man is no more valuable at 40

than at 30, is old at 50. But the doctor at 40 or 50 is a better doctor than he was at 30—and it's the same with men trained in other fields—executives, draftsmen, engineers, merchants, architects **are young at 40, at 50**—and still have many good pay years ahead. Promotion, higher pay, reward properly trained men!

American School, an educational institution incorporated "not for profit," has used for over 40 years a direct and practical method for preparing men to handle the **bigger jobs in business and industry.**

American School graduates hold important positions as engineers, accountants, experts, draftsmen, managers, etc., or successfully operate their own business. Thousands of our High School graduates have entered colleges, universities, normal schools, etc., have attained success in business or industry.

Find out how American School can help **YOU**, the difference it may make in your entire future **success and happiness!** Mail coupon today for **free Bulletin** and early lesson in field of your choice. No obligation on your part.

American School, Dept. G946, Drexel Ave. at 58th St., Chicago

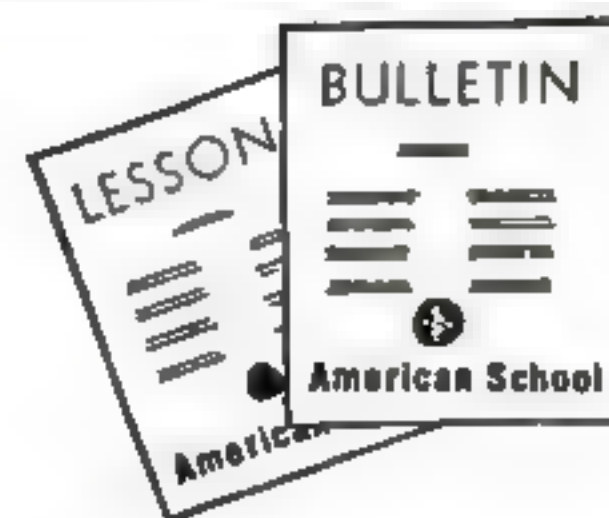
Cut Along This Line

Try a Lesson Yourself—No Obligation

American School, Dept. G946, Drexel Ave. at 58th St., Chicago

I have checked the line of work in which I would like a good job. Please send me without expense or obligation on my part a copy of your Bulletin and an early lesson in the field I have selected.

- | | | |
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| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Law |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Diesel Engineering | <input type="checkbox"/> Liberal Arts (College) |
| <input type="checkbox"/> Automotive Engineering | <input type="checkbox"/> Drafting and Designing | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Automobile Repairing | <input type="checkbox"/> Electric Refrigeration | <input type="checkbox"/> Merchandising |
| <input type="checkbox"/> Bookkeeping and | <input type="checkbox"/> Heating, Ventilating, | <input type="checkbox"/> Private Secretary |
| Cost Accounting | Plumbing | <input type="checkbox"/> Radio and Television |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Professional Accounting | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Civil Engineering | Incl. C. P. A. Coaching | <input type="checkbox"/> Shop Practice |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> High School | <input type="checkbox"/> Steam Engineering |
| <input type="checkbox"/> Contracting, Building | <input type="checkbox"/> Highway Engineering | |



Name _____ Age _____ Occupation _____

Street _____ City _____ State _____

Our Readers Say (CONTINUED)

haps one of your readers has observed a similar phenomenon and can give me the explanation. It must have been a shadow and not a reflection because the net was of a dark color.—P. H., Eureka, Utah.

There's No Doubt About It, It's a Much Simpler Idea

THAT outfit with the hand and dial and strings that shows a motorist when his car is backed the proper distance into his garage was ingenious to say the least. I can't help thinking that it would have been simpler

YEAH, BUT US GADGETEERS LIKE TO DO THINGS THE MOST COMPLICATED WAY!



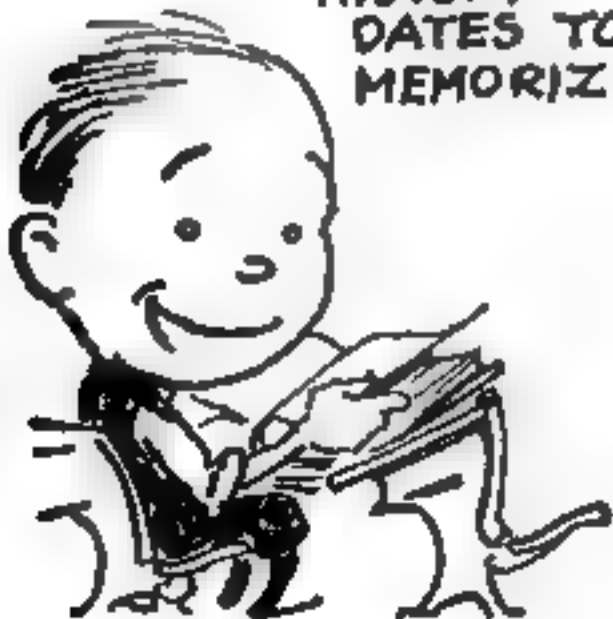
just to put a two-by-four along the floor near the back of the garage, which would have indicated its presence when the wheels touched it. On the other hand, I tried this with near disastrous results. To brace the two-by-four, I ran two short pieces from it to the wall studs at the back of the garage.

One night I came home in a hurry and hit the board a little too hard, shoving the rear wall practically off its foundation. The best and simplest device I've run across yet is this. Take a springy piece of wire and stick it in a hole drilled in the wall exactly opposite the windshield upright when the car is all the way in. As you drive in (frontwards), it's easy to tell when the car is all the way in by just watching the tip of the wire. Put an eraser over the end of the wire so it won't scratch anybody's eye out.—C. H. E., Bridgeport, Conn.

You Never Learn the Truth Until the War's Over

LIKE your many other readers, I have been interested for years in following the new developments in war weapons as so ably reported in your columns. Always the question was: "How will these untried armaments show up under the actual test of modern war between major powers?" Now, unfortunately, such a war has actually broken out, and we might find some compensation for its horrors in having that question answered. But do we? No, indeed. As soon as the first shot was fired, the censorship

SWELL, THEN WE WON'T HAVE HISTORY DATES TO MEMORIZE!



as the first shot was fired, the censorship

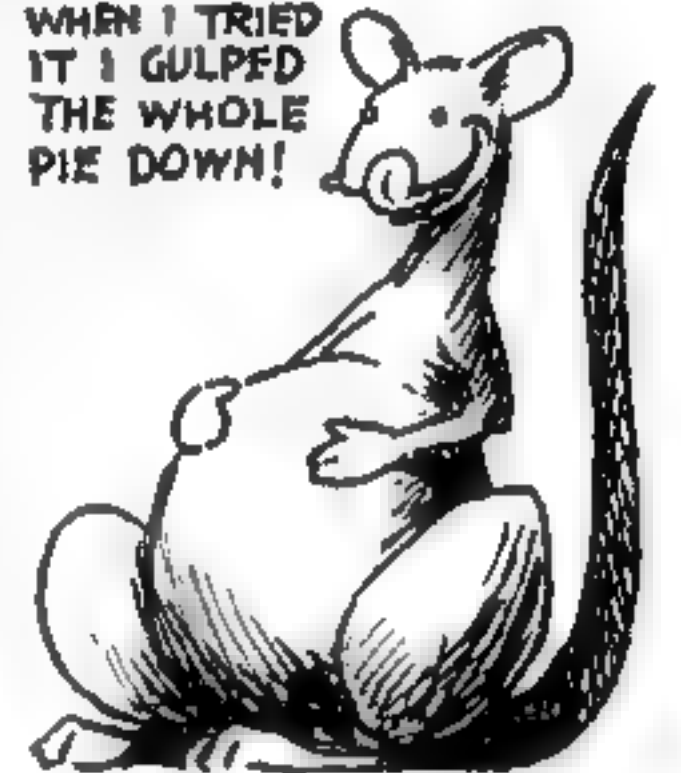
(Continued on page 16)

was clamped down so tight that the war might as well be on another planet for all we can know about it. I suppose the truth will be told some day about the battles that are being fought now, but by that time we'll be so sick of the idea of war that we won't want to hear about it.—A. D., Seattle, Wash.

That's a Big Piece of Pie Even for a Wide-Angle Mouth

MY WORK is driving a loco' for the New South Wales Government Railways, and I take much interest in the problems appearing in "Our Readers Say." Here is the solution to S. A. M.'s problem about the pie eater with the wide-angle mouth (and appetite). By guess and trial, plus the use of mathematical tables and the aid of Euclid, I find the required measurement of the mouth that bit the piece out of the pie to be 3.1 inches—nearly. I've been a regular reader of your magazine since last February, and find it most interesting.—R. B., Chullora, N. S. W., Australia.

WHEN I TRIED IT I GULPED THE WHOLE PIE DOWN!



Can This Mean They've Got 'Em in Australia, Too?

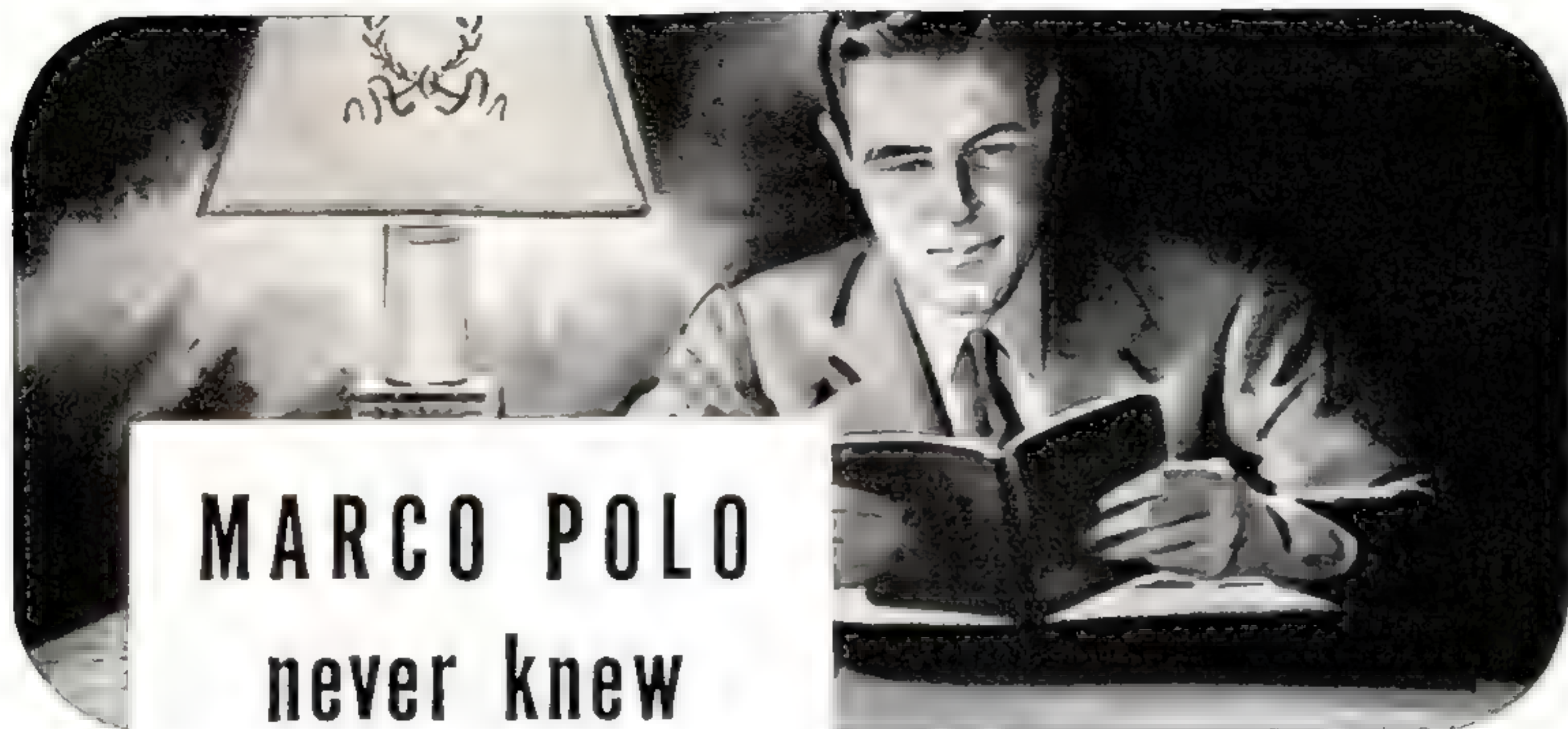
AM ALWAYS pleased to get my copy of P.S.M., and I don't ask for any changes. I have seen some good ones in the readers' letters, so would you let me suggest one? How about some one making some concentrated honesty that could be injected into our politicians, and then some one trapping and holding the politicians? I'll volunteer to use the needle.—C. C., Huskesson, N. S. W., Australia.

MAYBE I NEED THIS FOR HORNING IN TWICE!



Hickory, Dickory, Dock, The Dog Replaced the Clock

SOME time ago, I read a letter from one of your readers in which he pondered the reason for his waking up every morning just before his alarm clock was set to go off. I've often had the same thing happen, but that's not what I'm writing about, specifically. What I'd like to hear some reader's opinion on is a somewhat similar phenomenon concerning my dog. It's the custom of our small



MARCO POLO never knew GREATER THRILLS

BOLD MARCO POLO, pushing eastward into the unknown, never knew greater thrills of discovery than this student of the International Correspondence Schools! His I. C. S. text is his guide-book to new and thrilling adventures in the world of knowledge.

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day, on his job, he experiences the grand ADVENTURE of seeing newly learned truths demonstrated.

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BOX 7672-J, SCRANTON, PENNA.

★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X: ★

TECHNICAL AND INDUSTRIAL SUBJECTS

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| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Air Brakes | <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Manufacture of Pulp Paper | <input type="checkbox"/> Sanitary Engineering |
| <input type="checkbox"/> Air Conditioning and Cooling | <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Diesel Engineering | <input type="checkbox"/> Marine Engineering | <input type="checkbox"/> Sheet Metal Work |
| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Mechanical Drafting | <input type="checkbox"/> Steam Electric Engineering |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Fire Boilers | <input type="checkbox"/> Fruit Growing | <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Steam Engineering |
| <input type="checkbox"/> Auto Electric Technician | <input type="checkbox"/> Heating | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Mine Foreman | <input type="checkbox"/> Steam Fitting |
| <input type="checkbox"/> Auto Technician | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> House Planning | <input type="checkbox"/> Patternmaking | <input type="checkbox"/> Structural Drafting |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> House Planning | <input type="checkbox"/> Machinist | <input type="checkbox"/> Pharmacy | <input type="checkbox"/> Structural Engineering |
| <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> Radio | <input type="checkbox"/> Plumbing | <input type="checkbox"/> Surveying and Mapping |
| <input type="checkbox"/> Bridge Engineering | | <input type="checkbox"/> R. R. Locomotives | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Telegraph Engineering |
| <input type="checkbox"/> Building Estimating | | <input type="checkbox"/> R. R. Section Foreman | <input type="checkbox"/> Radio | <input type="checkbox"/> Telephone Work |
| <input type="checkbox"/> Chemistry | | <input type="checkbox"/> R. R. Signalmen | <input type="checkbox"/> Refrigeration | <input type="checkbox"/> Toolmaking |
| <input type="checkbox"/> Civil Engineering | | | | <input type="checkbox"/> Ventilation |
| <input type="checkbox"/> Coal Mining | | | | <input type="checkbox"/> Welding, Electric and Gas |
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BUSINESS SUBJECTS

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| <input type="checkbox"/> Accounting | <input type="checkbox"/> Advertising | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Grade School Subjects | <input type="checkbox"/> Railway Postal Clerk | <input type="checkbox"/> Signs |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> High School Subjects | <input type="checkbox"/> Salesmanship | <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> First Year College Subjects | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Illustrating | <input type="checkbox"/> Secretarial Work | |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> French | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Lettering Show Cards | <input type="checkbox"/> Stenography and Typing | |
| <input type="checkbox"/> Cartooning | <input type="checkbox"/> Civil Service | | <input type="checkbox"/> Traffic Management | | |

DOMESTIC SCIENCE SUBJECTS

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| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Home Dressmaking | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Professional Dressmaking and Designing | |

Name..... Age..... Address.....
City..... State..... Present Position.....

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada
British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

Our Readers Say (CONTINUED)

family to sit down to breakfast at the latest possible moment that will permit us to eat and get up again and meet our various appointments. Fortunately, for the cook at least, we all leave the house at the same time. This means getting up from the table at the same time, or somebody is late for school or business. We eat in a small breakfast room that has a clock that broke recently. For a while after it broke, some one was always dashing into the next room between mouthfuls to see what time it was, until one morning it dawned on us that my dog always barked at the exact time we were in the habit of getting up from the table. She's our clock, now, and she's never failed to come barking up to the table at just the right time for two months. How do you suppose a dog knows what time it is?—H. R., Pittsburgh, Pa.

It's Something To Stew Over While Watching for the Pot To Boil

HERE'S a kitchen mystery for scientifically minded readers, and a possible explanation. Suppose you are boiling some water, or reheating a pot of coffee, on the gas range. Shut off the burner just before it comes to a boil—and it starts to steam, as if turning out the flame made it hotter! I thought I was seeing things the first time I noticed this. After puzzling over the paradox for some time, I hit on the following theory. As the water approaches the boiling point it is steaming, all right, but the steam is hot enough to be invisible. When the burner is turned off, the temperature in the pot drops. This allows the steam to cool a little, so that it condenses and becomes visible. Right?—J. Y., Bridgeport, Conn.

ME AND WATT, ONLY HE DID SOMETHING WITH IT!



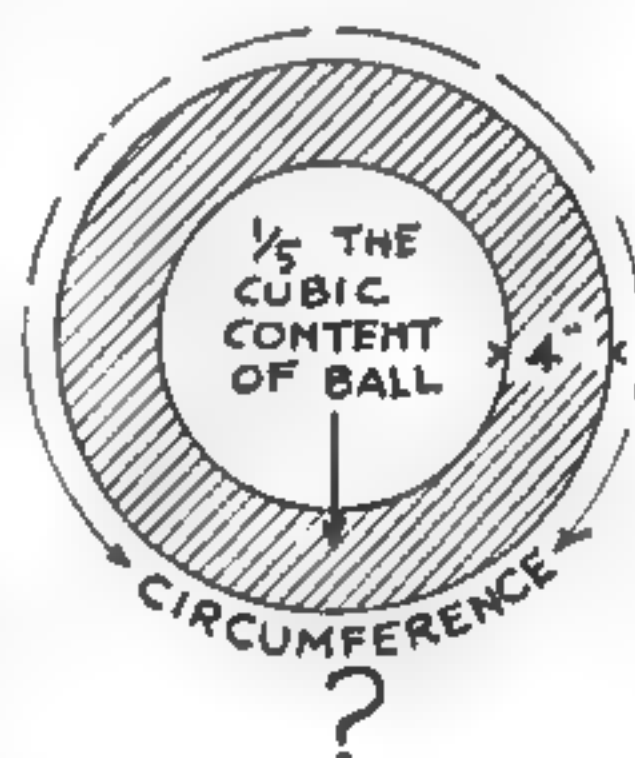
He Can Improve on the Name — for a Good Ten Minutes!

IN THE article about the "Garden of Queer Plants," it is mentioned that the garden contains an Australian plant with seed pods that resemble birds. I thought the owner of the garden might be glad to hear that if he should ever have the misfortune to lose his bird plant, we have 2,400 acres of land covered with several million of them and he is welcome to all he wants to carry home. We refer to them, in our rustic way, as "devil claws," though any unfortunate farmer who happens to get one around his ankle can usually improvise and improve on the name for a good ten minutes; that being

the usual length of time it takes to unhook said claw. For tenacity and blood-drawing ability, they are two degrees above fish hooks. We are enjoying your magazine a lot. Power to you!—B. P., Medicine Lodge, Kans.

It Took Only Fifteen Minutes Plus Two Hours for Checking

IT WAS no task at all to knock out that "tough" tank problem a few months back. I did it in fifteen minutes (plus about two hours to check the dimensions against the volumes). Since you like problems for your magazine, here is a good one, and not too hard for mathematically minded readers to solve. Problem: If the shell of a hollow ball is four inches thick and contains one fifth of the cubical contents of the whole ball, what is the outer circumference of the ball?—J. J. M., San Francisco, Calif.



That's One Order That Probably Will Be Obeyed

SHADES of Hercules! Can it be that America is training an army of supermen to whom the puny, .45 caliber automatics and the measly rifles the A.E.F. was equipped with will be as popguns to the hand weapons they'll carry in future wars? In the article "Uncle Sam Arms Against the World" in the October issue, is a picture that suggests this as a possibility. Look closely at the sixteen-inch gun in the photograph on page 59. Three quarters of the way up the barrel you'll see, if your eyes are sharp, the words "DON'T TAKE." Now who, or what, in the Sam Hill do they mean? How is anybody going to "take" a sixteen-inch gun, and where would he take it to? Do you suppose



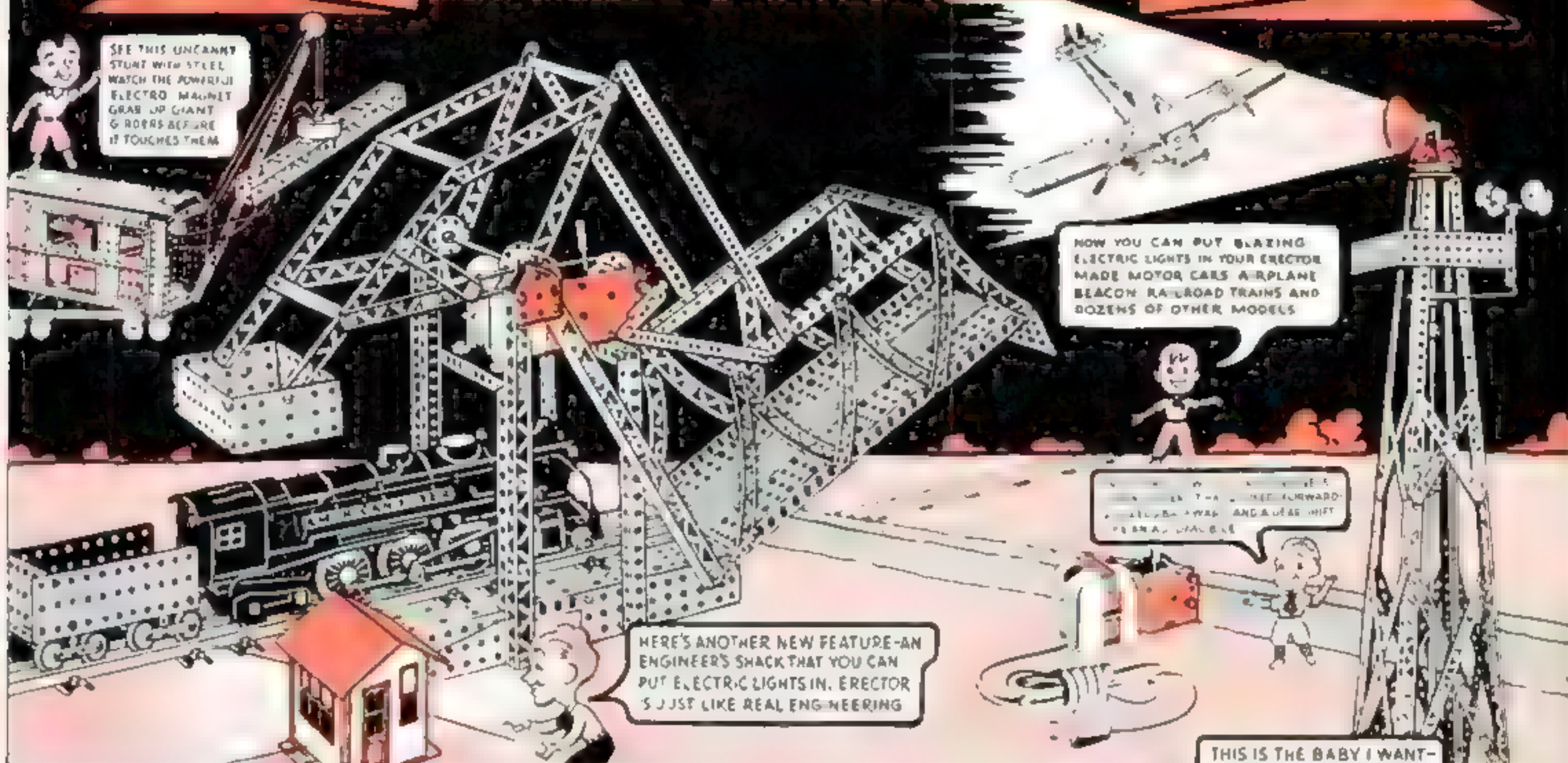
it was meant to warn foreign spies not to "take" the gun's picture? Or were the words somehow printed on the film the photographer used. Maybe I was right the first time, and the gun is for Herculean rookies of the future to practice the manual of arms with, and the sign was put

there to discourage some impatient tyro soldier from swiping the gun for a little secret practice.—T. C., Detroit, Mich.

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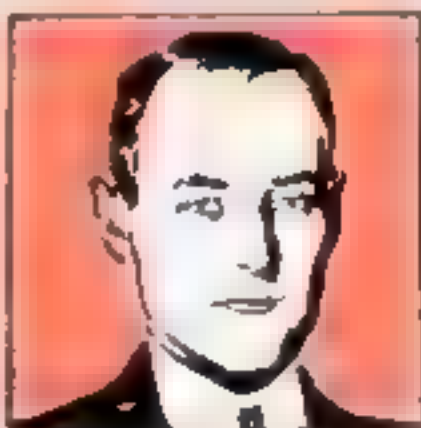
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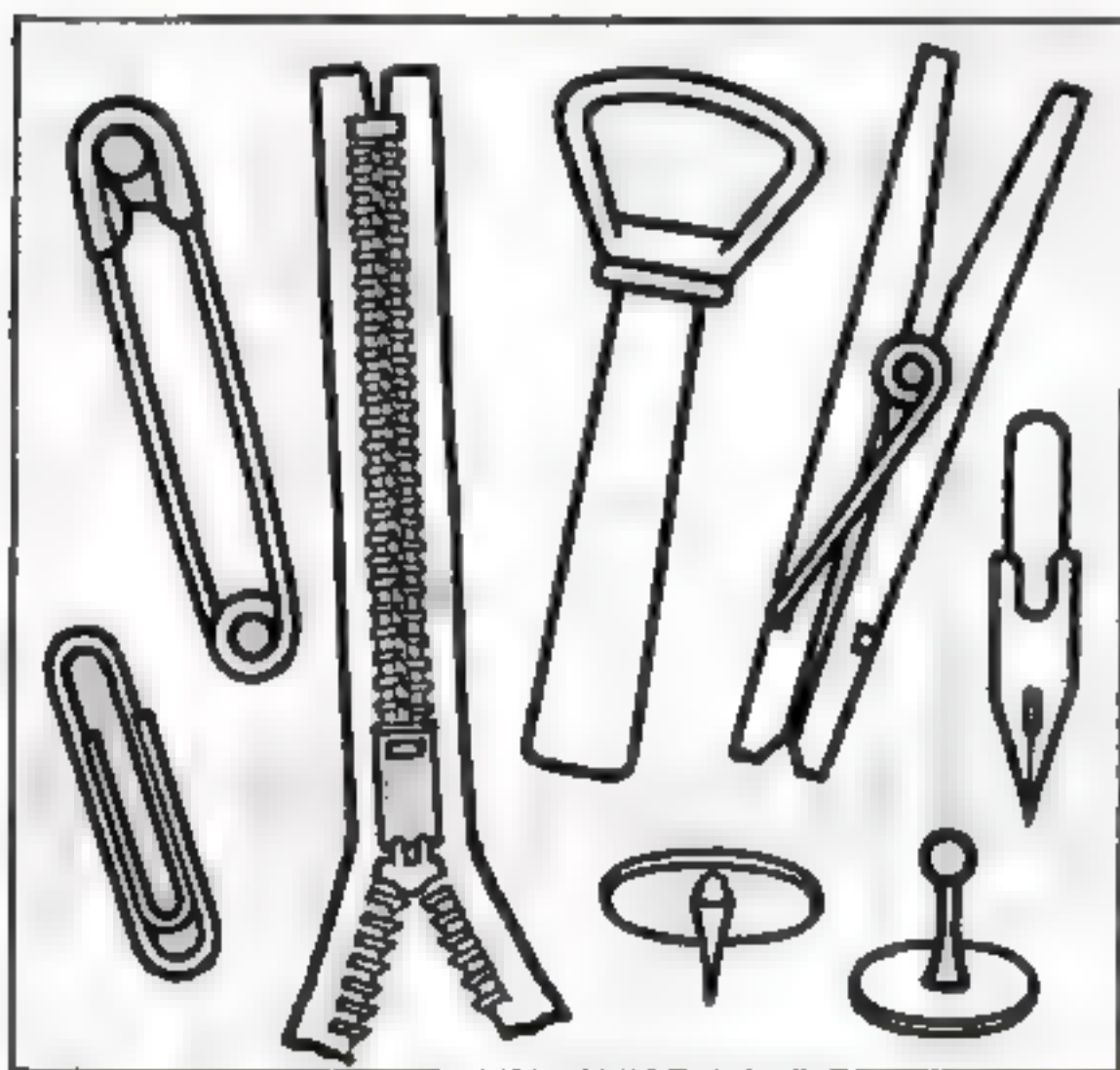
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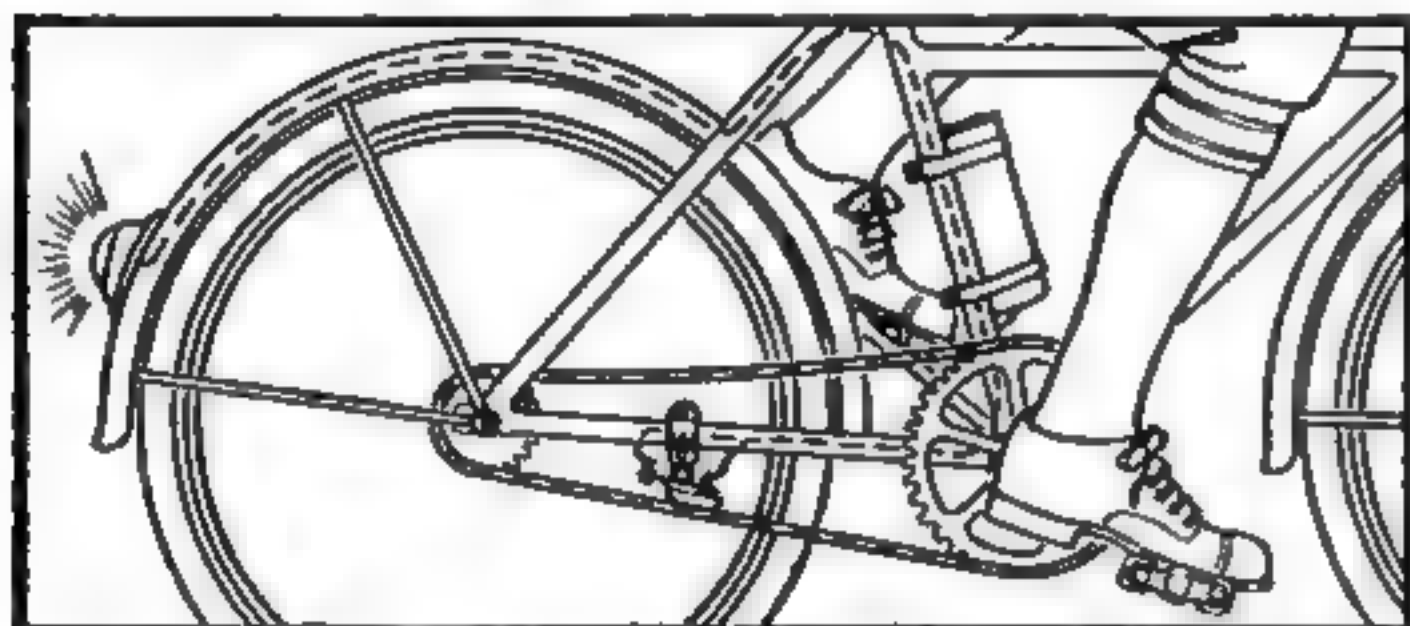
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With the Inventors

AUTOMATIC stop lights for bicycles are made possible by an invention worked out by Thomas J. and James M. Murray, of Chicago, Ill. A battery-operated stop light mounted on the rear fender of a bicycle is



controlled by a switch installed on the bottom fork of the vehicle frame, close to the lower run of the driving chain. When the cycle is being pedaled forward, the upper part of the chain is taut, and the lower section sags sufficiently to clear the switch. But when the coaster brake is applied, the lower run of the chain tightens up so that it contacts the switch, thus turning on the stop light . . . THE COURTS HAVE HELD that an invention cannot be declared unpatentable merely because it is extremely simple, or because the idea for it might have occurred to anyone . . . PLENTY OF SPRING is put into the step of any youngster using a novel jumping device invented by Henry Wenker, of Elizabeth, N. J.



Designed to provide amusement and exercise, the jumping attachment consists of a metal brace that is strapped to the leg so that the foot rests on a wooden pedal-shape member. Between the latter and the ground is a V-shape spring on which the child hops up and down, the spring action pushing him upward and slightly

forward with each leap . . . IF ONE PERSON IS the sole inventor of a new product and another merely a partner backing it financially, the application for a patent must be made only in the name of the actual inventor . . . COINS, LIPSTICK, CIGARETTES, and

other small items can be conveniently carried in a triangular pocket built into a novel glove designed by Margaret Attanasio, of New York City.

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INCIDENTALLY, THE PATENT for this invention was granted in less than eleven weeks from the date of application. As patent procedure goes, that is very fast work . . .

HAND KNITTING IS SAID TO BE made easier by an invention of Ivar V. Thulin, of Upper Darby, Pa., that is worn over the index finger of one hand and through which the yarn is fed to the needles. By a simple motion of the finger, the device loops the yarn over the end of a needle, thus eliminating waste arm motion and the necessity of loosing the hold on the needles. Tension on the yarn can be adjusted by bending the arm . . . ALTHOUGH MOST OF THE sixty-five head examiners in the patent office are responsible for patent applications in a number of different classifications, two of them have all they can do to handle one subject each, and three others can take care of only



part of one subject. H. O. Cutting handles Electric Signalling; L. P. Harvey, Refrigeration; A. M. Lewers, part of Carbon Chemistry; W. J. Buttner, part of Registers; and C. D. Backus, part of Radiant Energy . . . HONEYBEES GET FIRST-CLASS touring accommodations in a traveling apiary developed by Theodore Turchenko, of Lisle, Ill. A

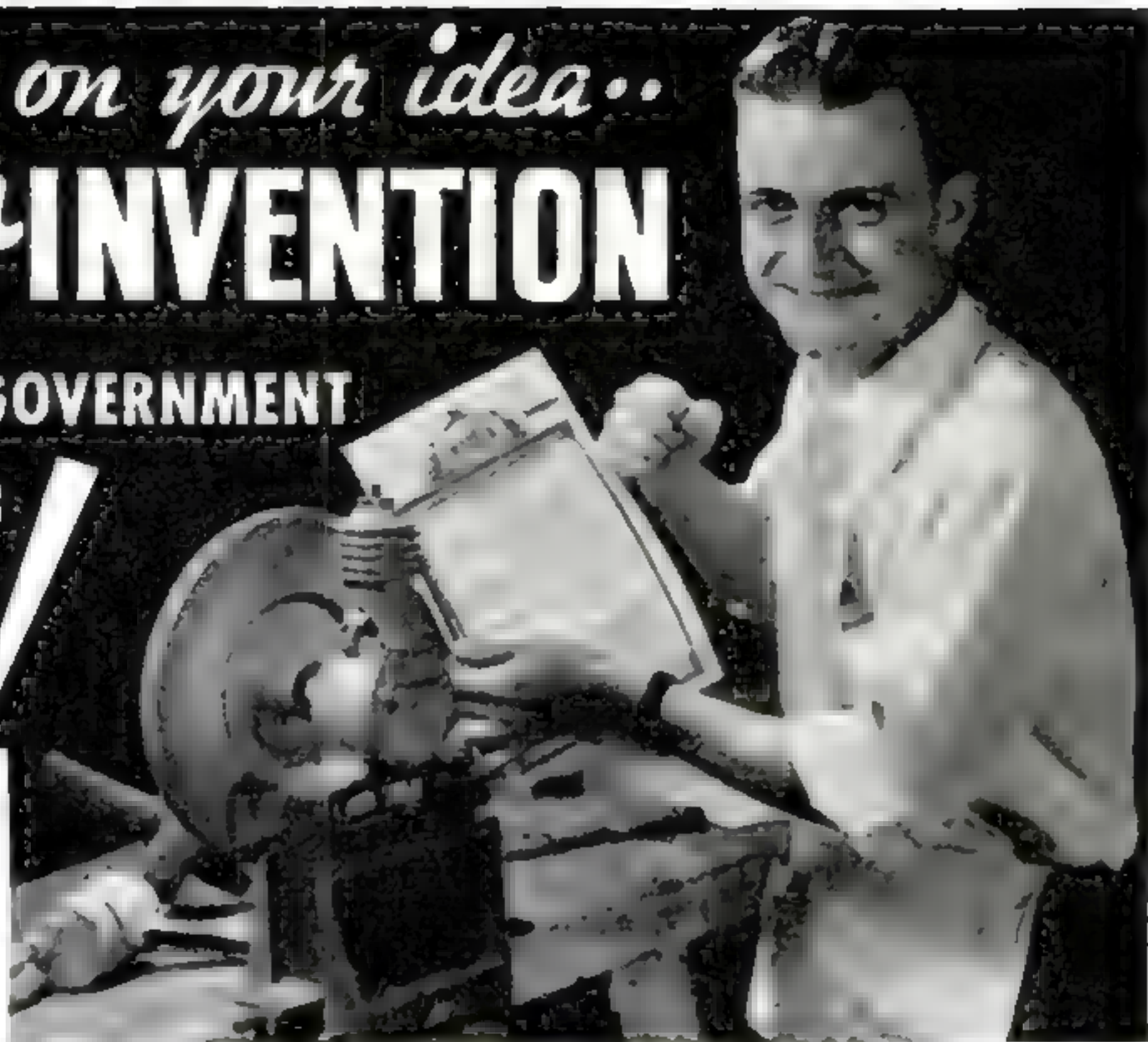
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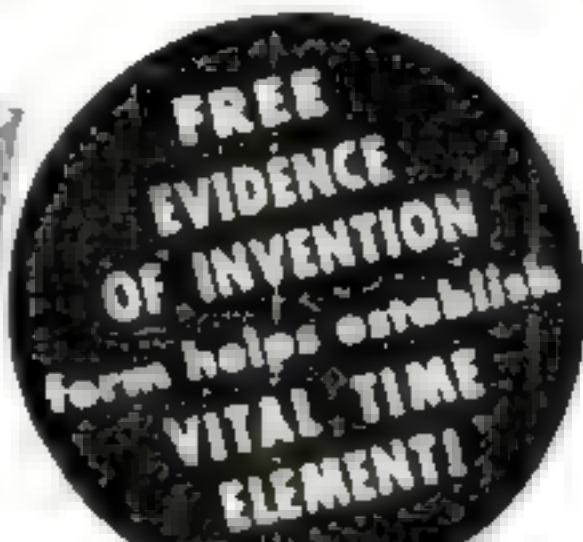
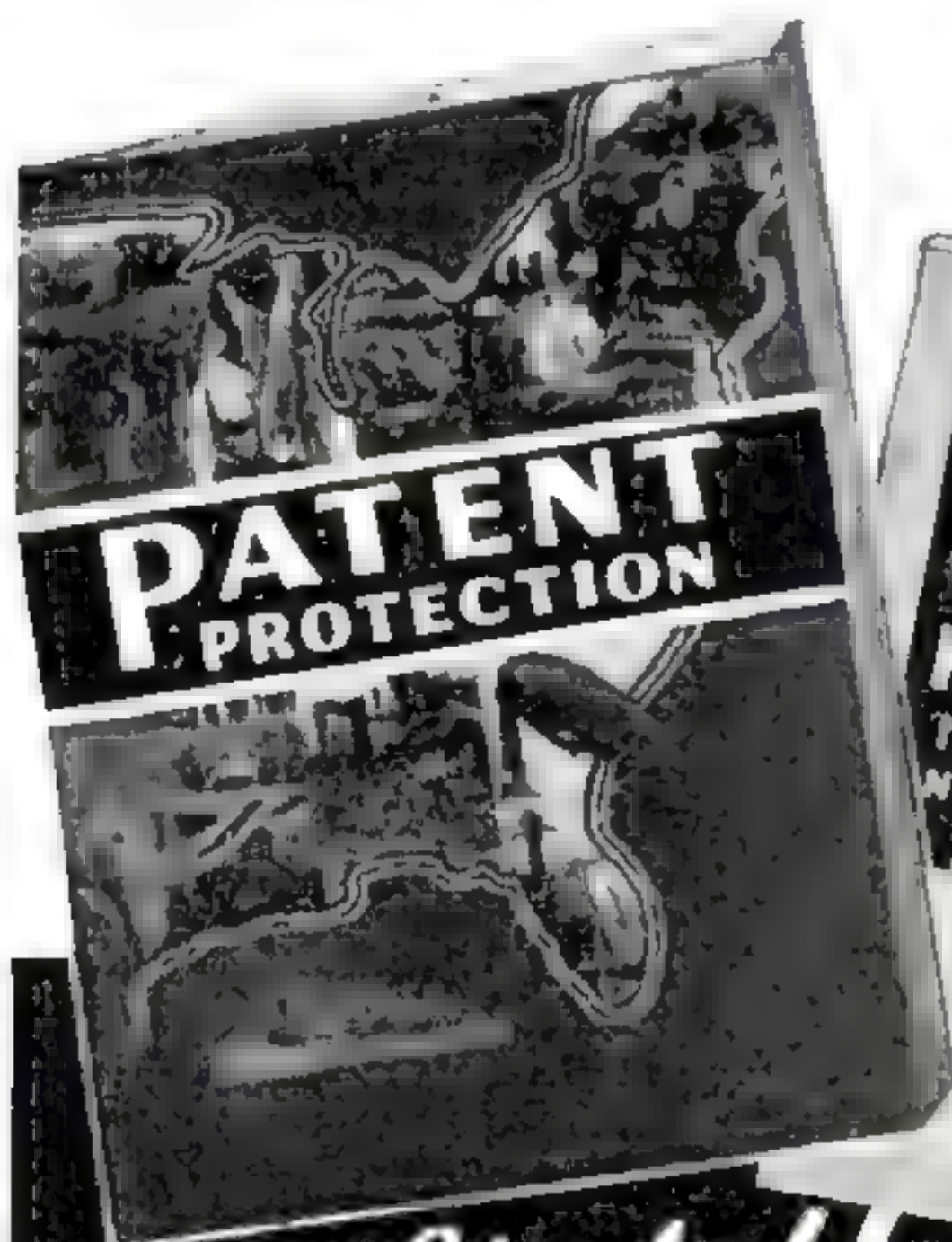
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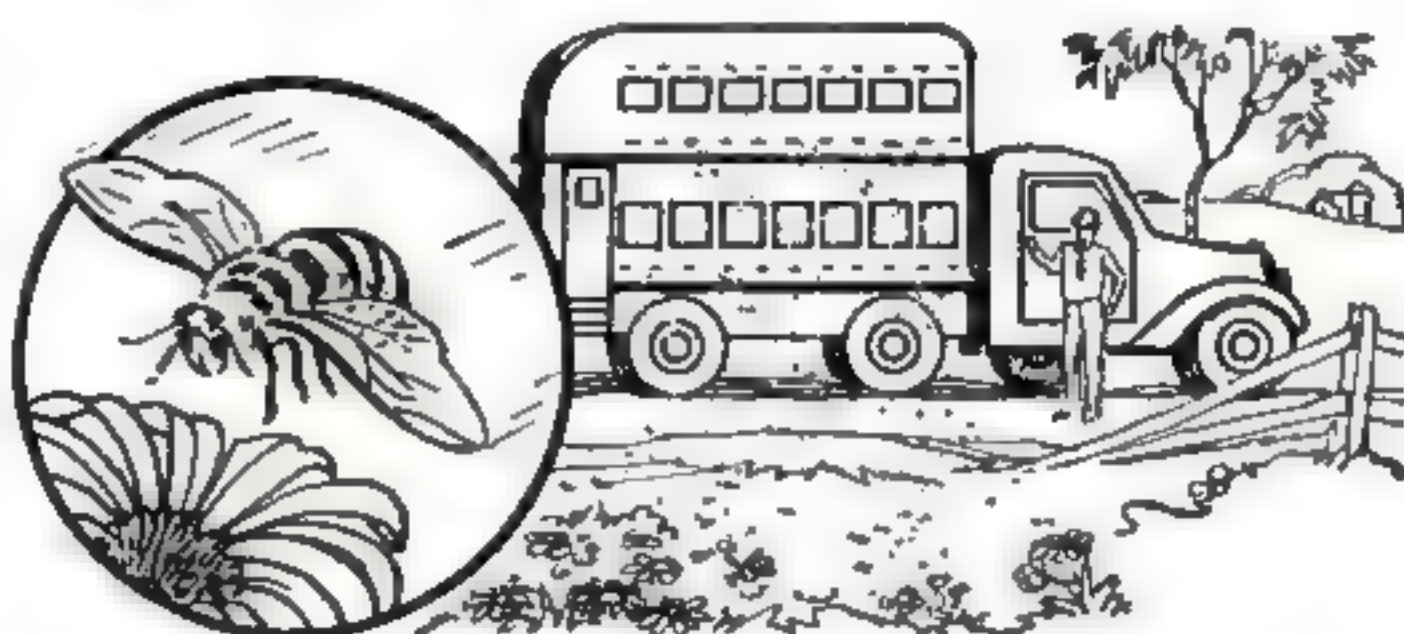
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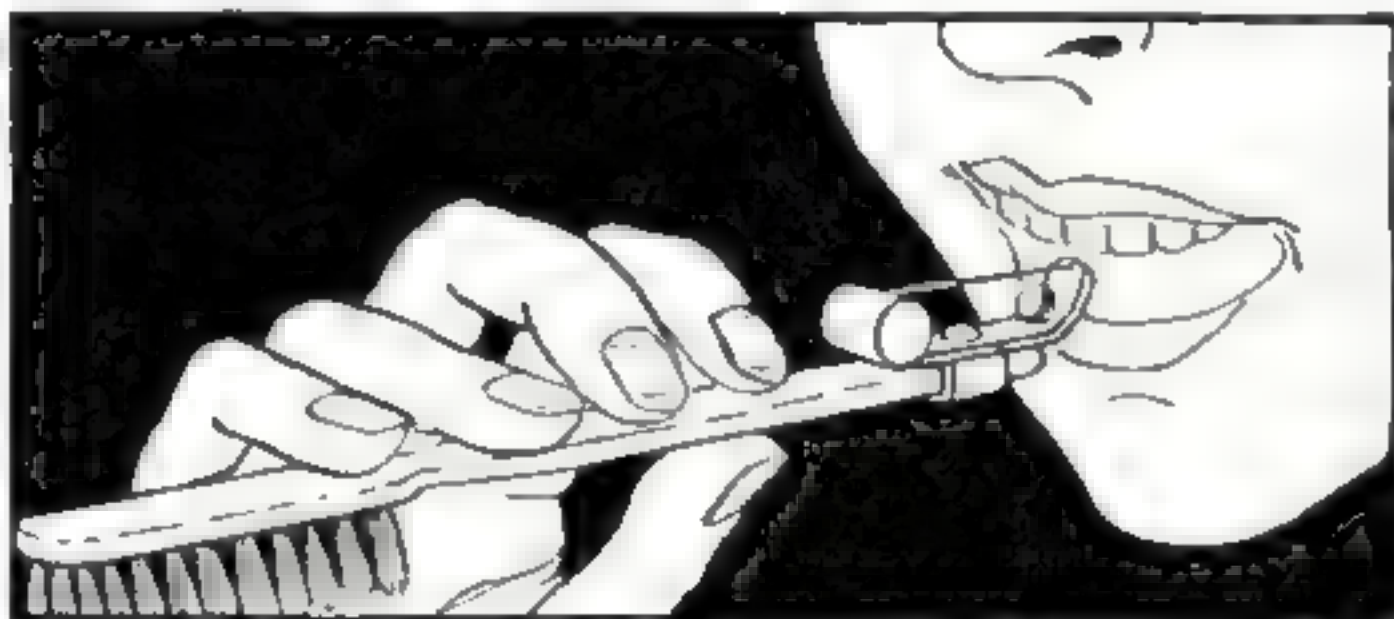
With the Inventors

(Continued from page 24)

special double-deck truck body is fitted with platforms along the sidewalls of both levels to support rows of beehives held rigidly in place. Slots in the truck walls, normally closed when the vehicle is under way, afford



an entrance and exit for the insects. The inventor states that by this method a person not owning good bee-raising land may travel from place to place, and produce honey on route. In the summer he might go northward, and move to warmer climates with the approach of winter . . . TOP TONSIL-TWISTING PATENT TITLES are almost always found among patents dealing with chemical developments. For example: "2-Alkylhexahydrobenzthiazoles and 2-Alkylhexahydrobenzselenazoles" . . . A DENTAL ACCESSORY just perfected by Arthur L. Peterson, of Long Beach, Calif., keeps dental floss for cleaning between the teeth always available for instant use while the teeth are undergoing their periodic brushings. The device consists of a bracket with a convenient loop that slips over the end of a toothbrush to hold the unit in place. On one end of the bracket a spool of the silk is contained within a metal holder. The other end is bent upward and provided with a notch into which



the end of the silk from the spool is inserted and held by means of a metal wedge. The taut silk is then ready for use without the need of inserting the fingers in the mouth for otherwise-awkward, between-the-teeth cleansing operations . . . A PROMINENT PATENT ATTORNEY states that of every 100 patent owners, ten are forced to sue persons

(Continued on page 28)

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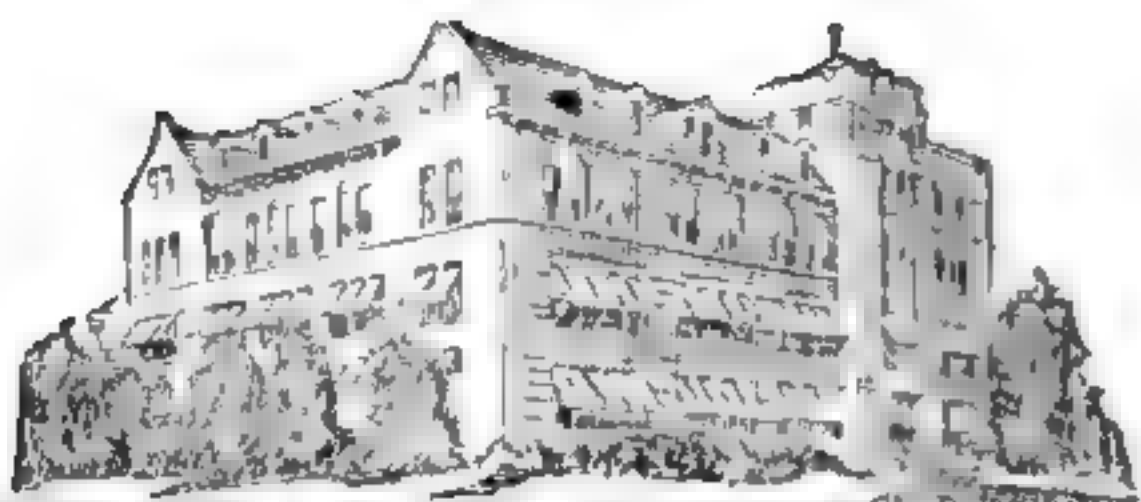
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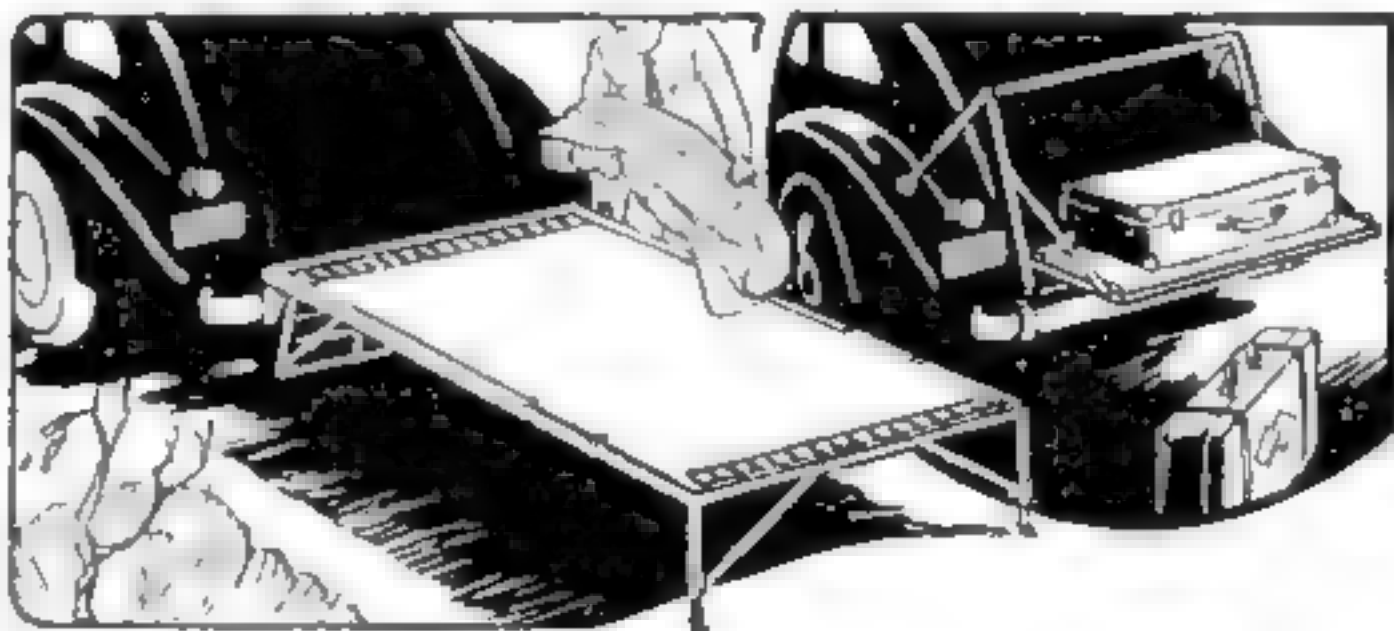
(Continued from page 26)

who infringe their patents... SHAPED SOMEWHAT LIKE an oversize tin whistle for youngsters, a recent invention patented by Samuel G. Richards, of Des Moines, Iowa, is



designed to simplify the task of affixing postage stamps to letters, packages, and pamphlets. Intended for use with rolls of stamps, the unit consists of a cylindrical chamber of which one end is removable for handy insertion of a new roll. A carrier extending from the cylinder at a tangent takes the stamps fed into it from the roll.

A slot in the back of the carrier allows the tip of the thumb to advance the strip of stamps one by one. In use, the device is held in one hand, a stamp is slid through the carrier from the container, rubbed across a wetting sponge, and pressed with one finger of the other hand against the piece to be mailed. The squared lip of the carrier tears the stamp loose from the strip with a flick of the hand... A HUMAN HAND cannot form an element in the claim of a patent... CAMPING COT AND LUGGAGE CARRIER are combined in a single unit that can be attached to the rear bumper of an automobile. Set in a metal framework with collapsible legs, canvas is stretched



between two rows of springs to form the bed, which extends out behind the car. An outstanding advantage is the fact that the bed's occupant is high enough above the ground for protection from crawling insects. When not in use, the bed folds up into a horizontal position to act as a convenient luggage carrier. William L. Chambers, of Ogden, Utah, developed the device.

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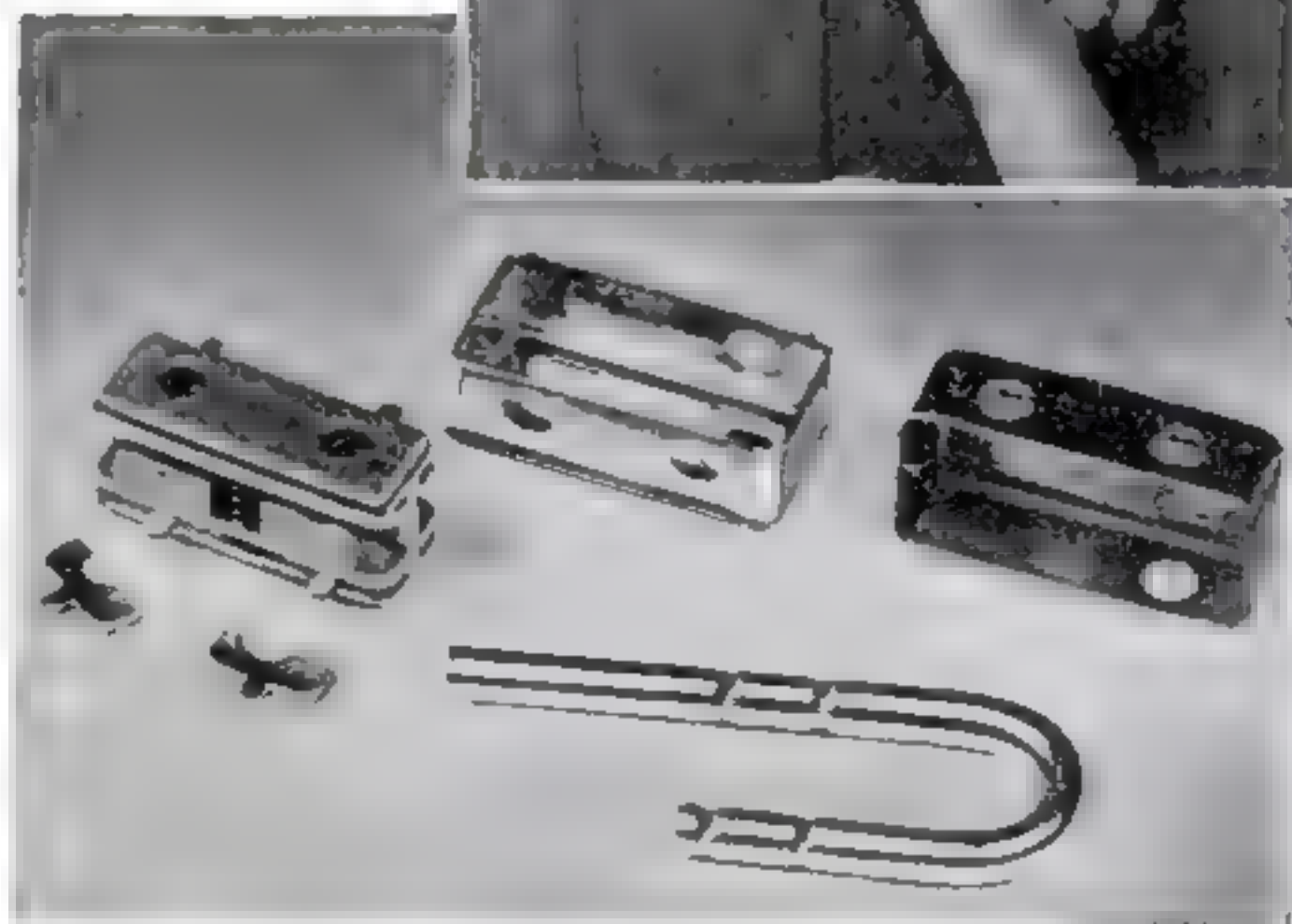
New Ideas

FOR HOME OWNERS

SHORT CIRCUITS resulting from dust, dirt, or tiny bits of metal getting down between the threaded metal end of a light bulb and the socket into which it is screwed, are prevented by a small collar made of molded rubber. The collar is fitted over the open end of the socket to form a preventive seal against the entrance of particles that might cause a "short."



A molded-rubber collar keeps dust out of the socket



Handy Keyless Padlock

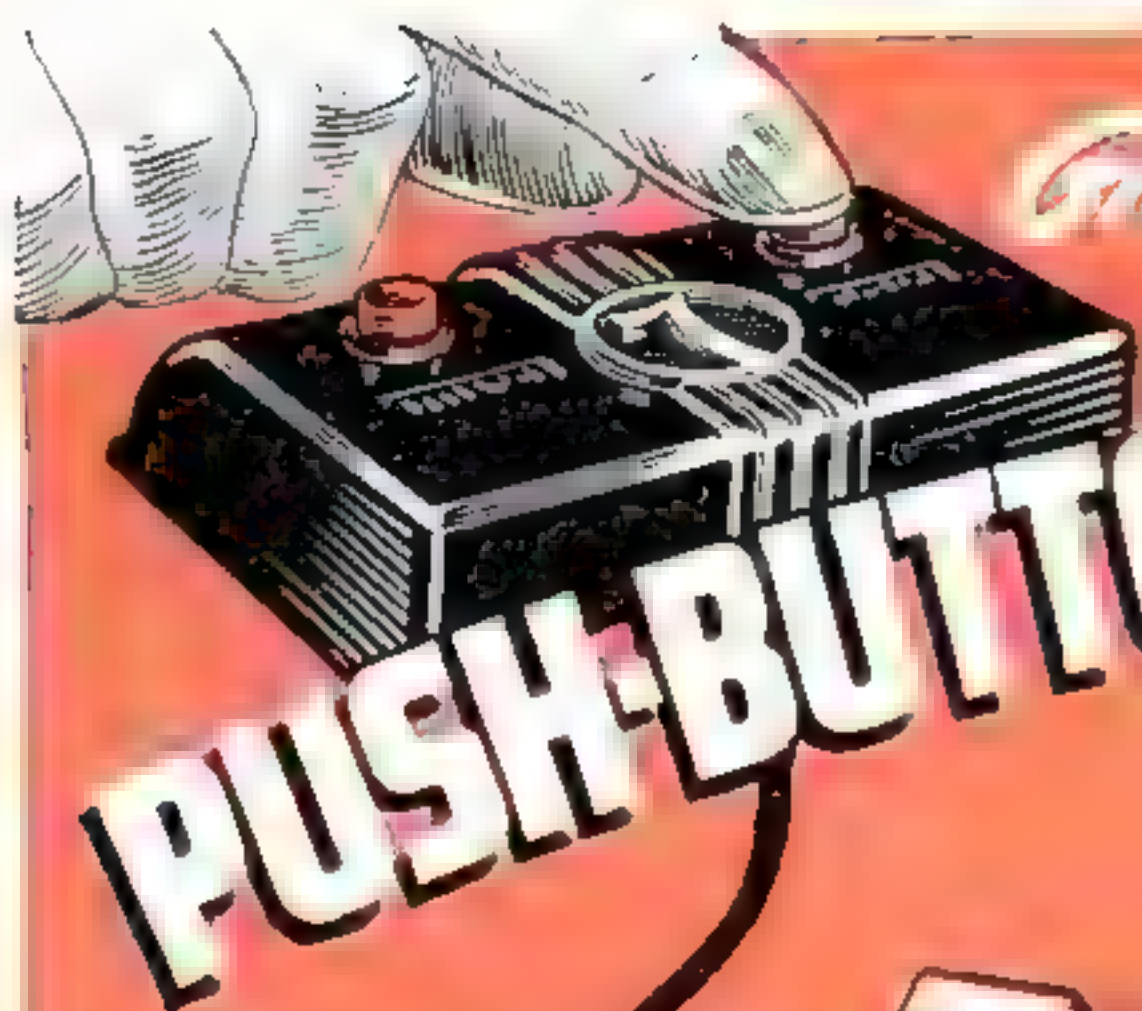
WHEN a handy keyless padlock just introduced is in unlocked position, it may easily be taken apart, permitting the owner to change the combination.

Stainless-Steel "Lumber" for Building

THIN sheets of stainless steel bonded to an inert mineral backing form a new type of strong, rigid paneling for use in building construction. Fireproof and weather-resistant, the novel material reflects about ninety percent of all the heat rays striking its polished surface, is practically free from warping, and has the quality of absorbing sound. Adaptable for either exterior or interior use, the metal lumber can be handled and worked almost as easily as wood.



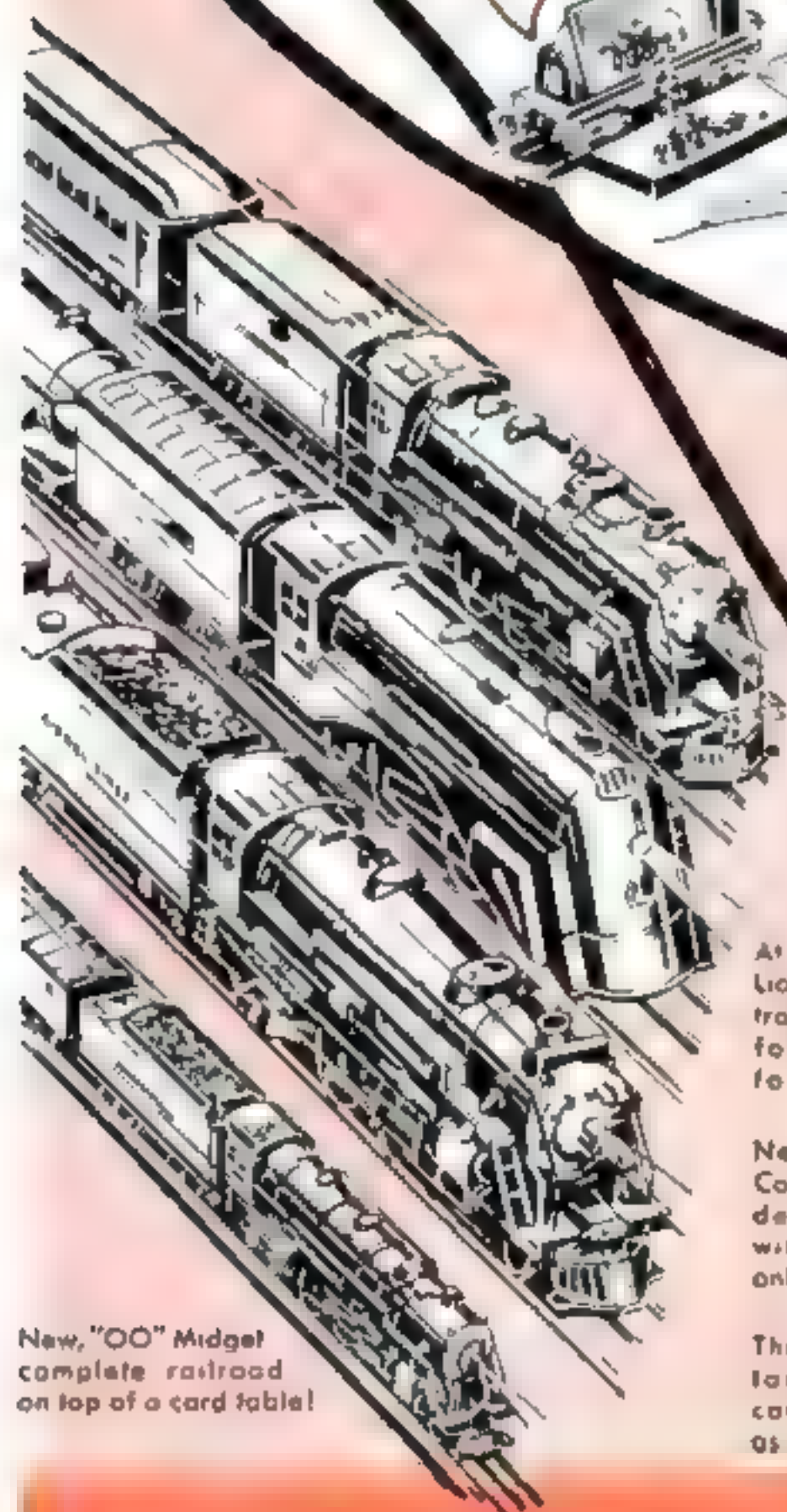
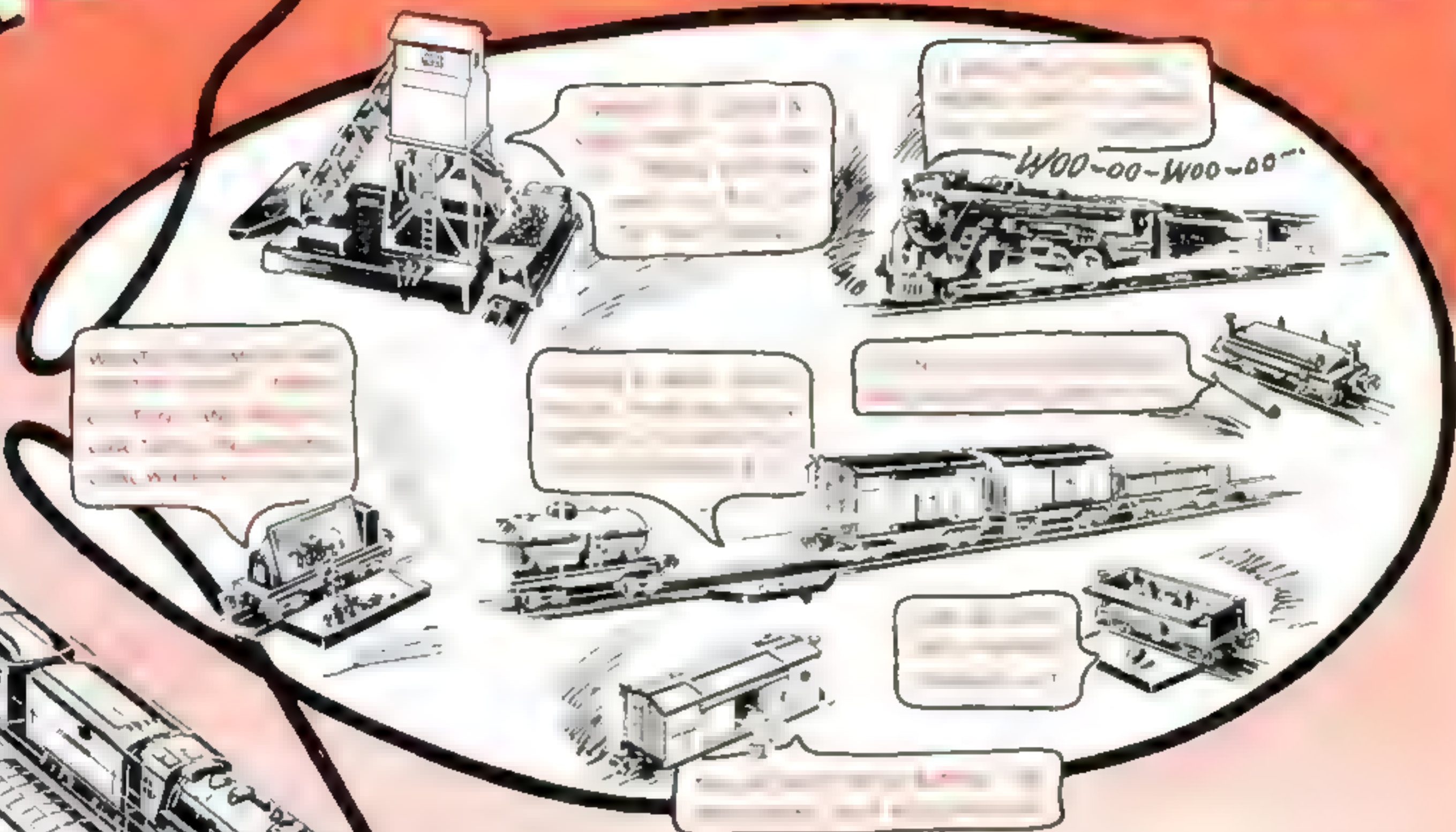
A building covered with the new metal-sheathed paneling. The inset shows how moldings can be applied



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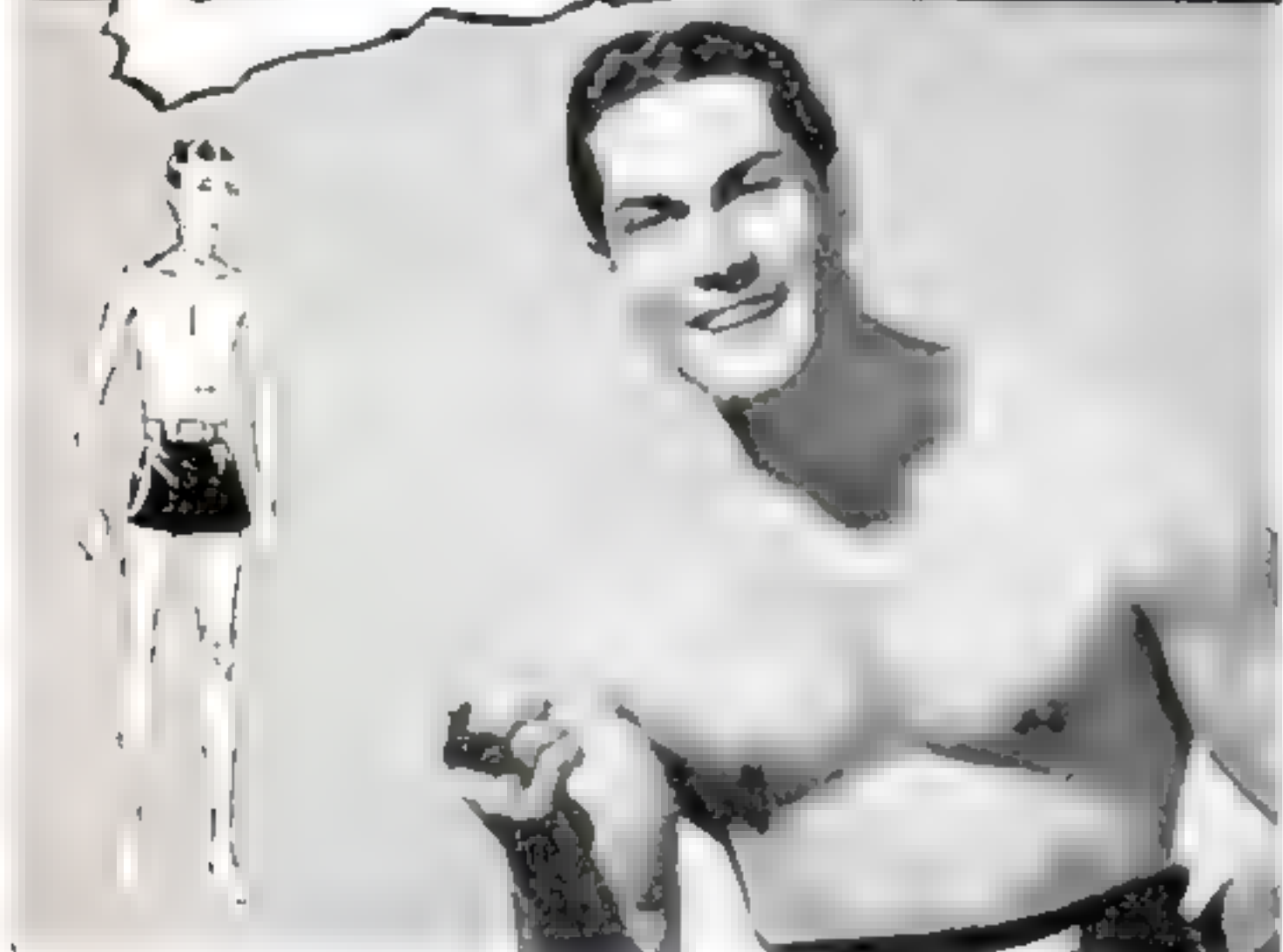
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Foamy suds are rubbed in and allowed to evaporate



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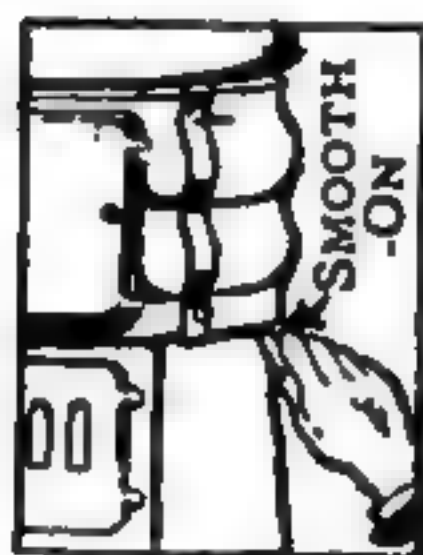
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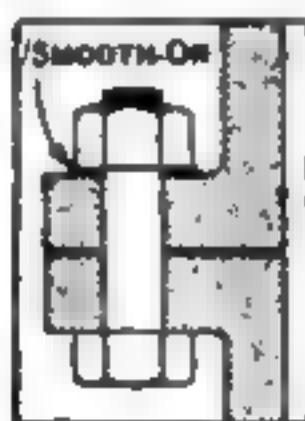
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Questions FROM HOME OWNERS

Q.—WE ARE remodeling part of our cellar into a recreation room. Can you tell me if there is any preparation which would be less expensive than stain, with which we could darken the joists and other wooden ceiling members to a color approximating walnut stain?—J. E. B., York, Pa.

A.—TRY using black asphaltum varnish, thinned with turpentine or a turpentine substitute. If this is unsatisfactory, make your own stain by mixing raw or burnt umber in a solution made up of one part of boiled linseed oil to four parts of turpentine. One or the other of these, depending on the kind and condition of the wood to be treated, should give you the color you desire.

Removing Grease from Wall Paper

Q.—ACCIDENTALLY, grease was splashed on the wall paper near our kitchen stove. What is the best way to remove the spots?—J. W. L., Cumberland, Md.

A.—PRESS a pad of blotting paper against the spots with a moderately hot iron. After most of the grease has been extracted by the blotter, dampen the spot, sprinkle on a little powdered pipe clay or fuller's earth, allow it to dry, and then remove it with a soft brush.

How To Rustproof a Stove Oven

Q.—IS THERE any way of preventing the metal lining of an electric-stove oven from rusting and scaling?—H. L., New York City.

A.—WE WOULD suggest painting the oven with aluminum paint. Before applying, all grease must be removed from the surface. If washed with strong soap and water, be sure that all trace of soap is removed with several rinsings of clear water.

Washable Coating for Painted Walls

L. P., WATERBURY, CONN. A starch coat is sometimes applied over painted walls so that they may be washed without fear of harming the paint job. Rub regular laundry starch to a thin paste in cold water, and then bring it to a clear solution in boiling water before applying to the walls. When they become soiled, wash the starch off with a sponge and warm water and apply a new coating. In this way, the paint job can be made to last indefinitely in spite of frequent washing.

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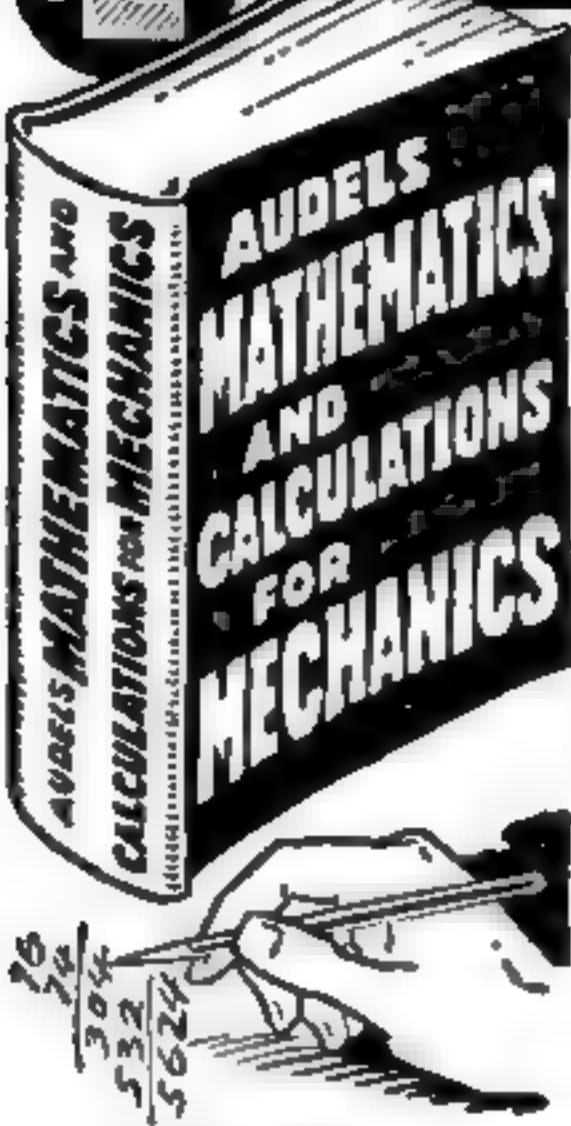
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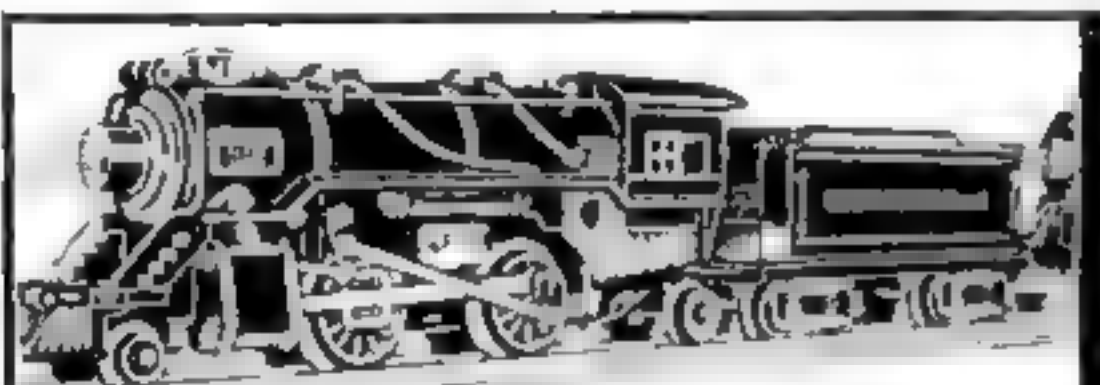
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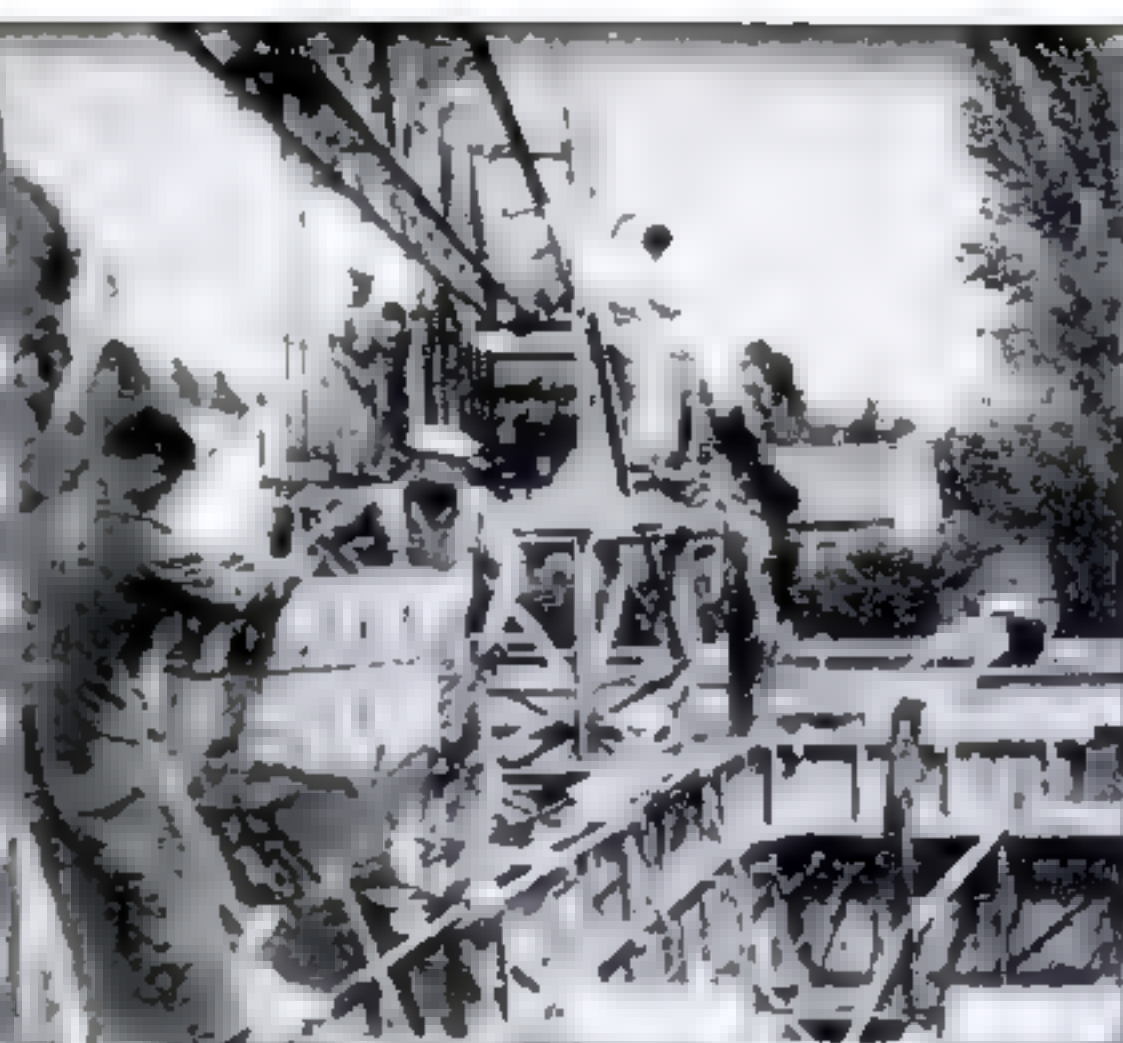
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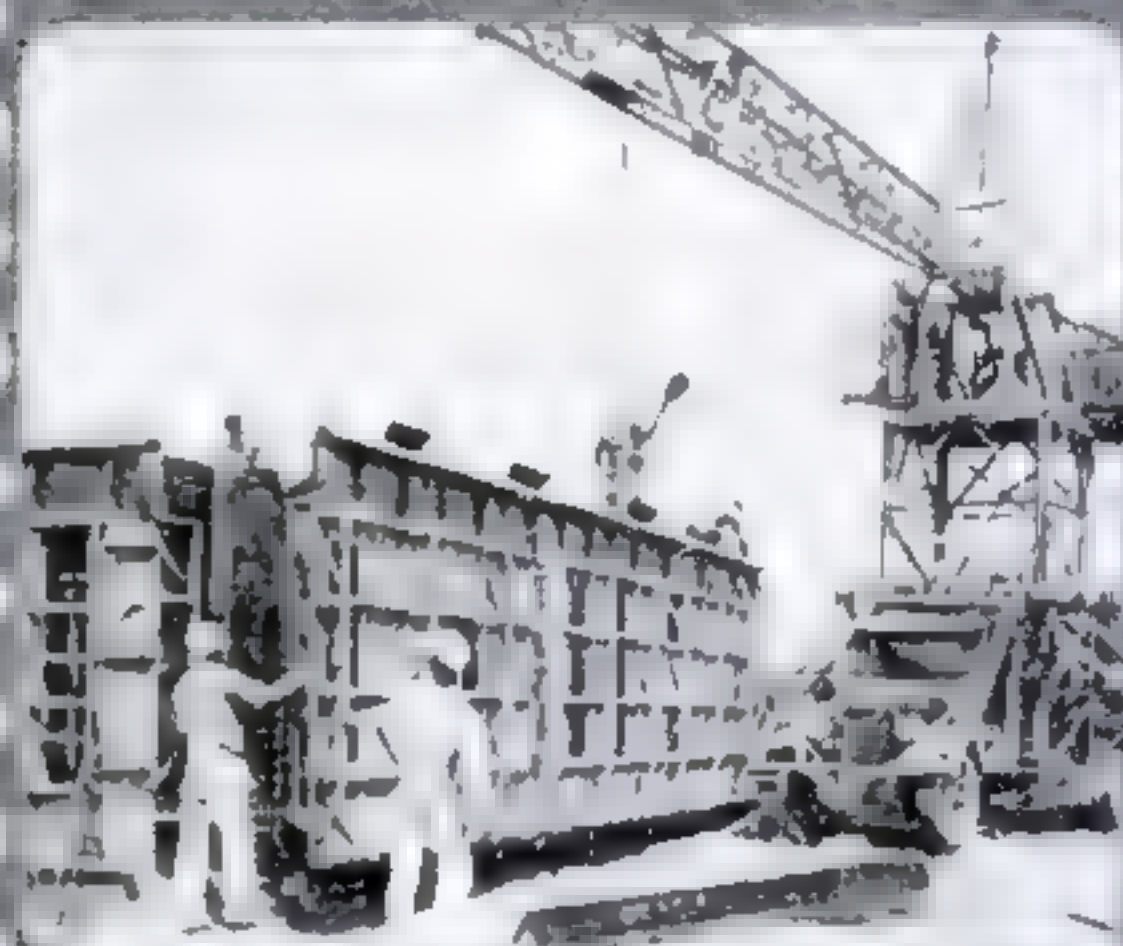
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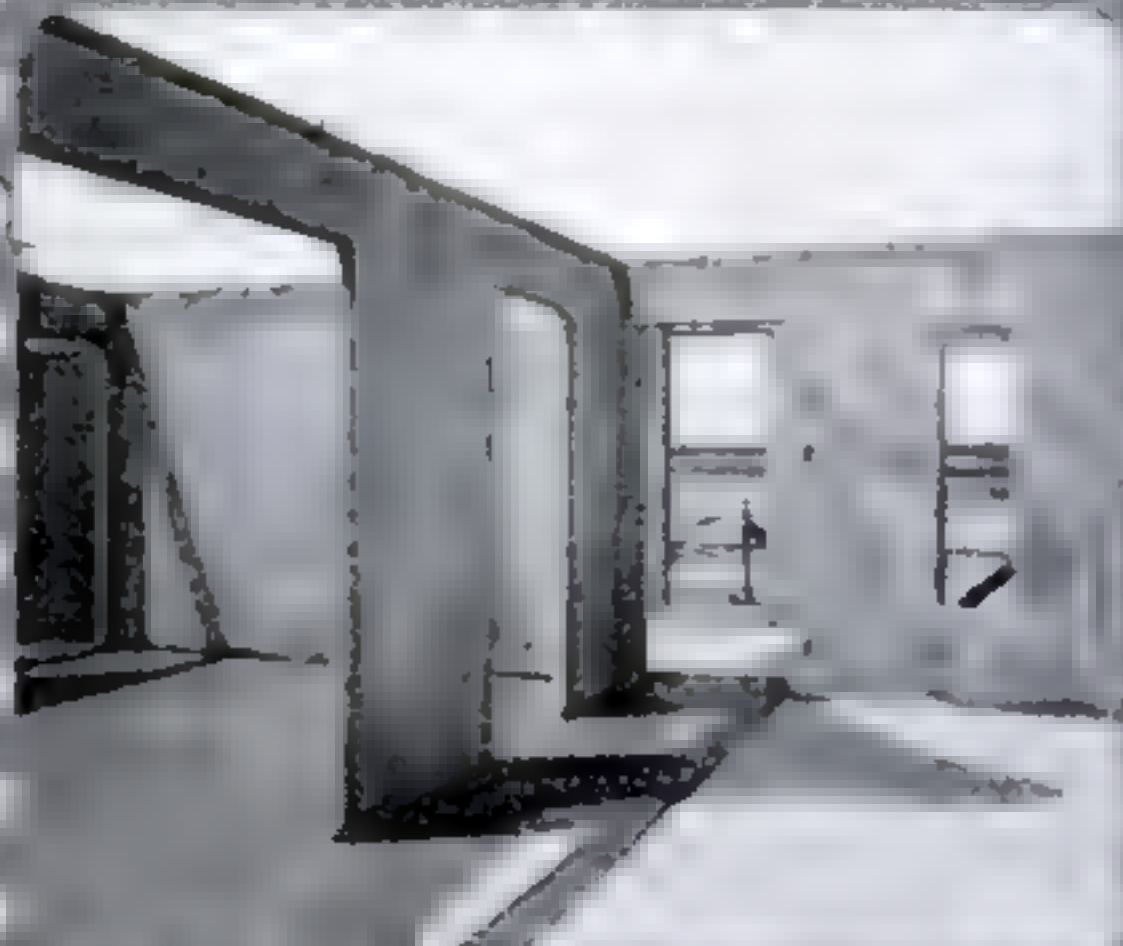
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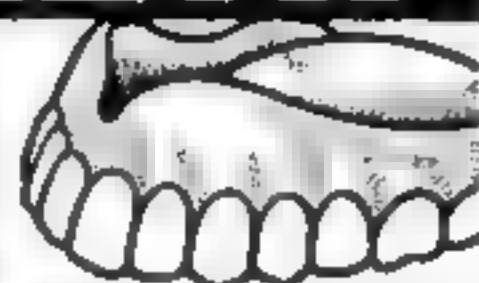
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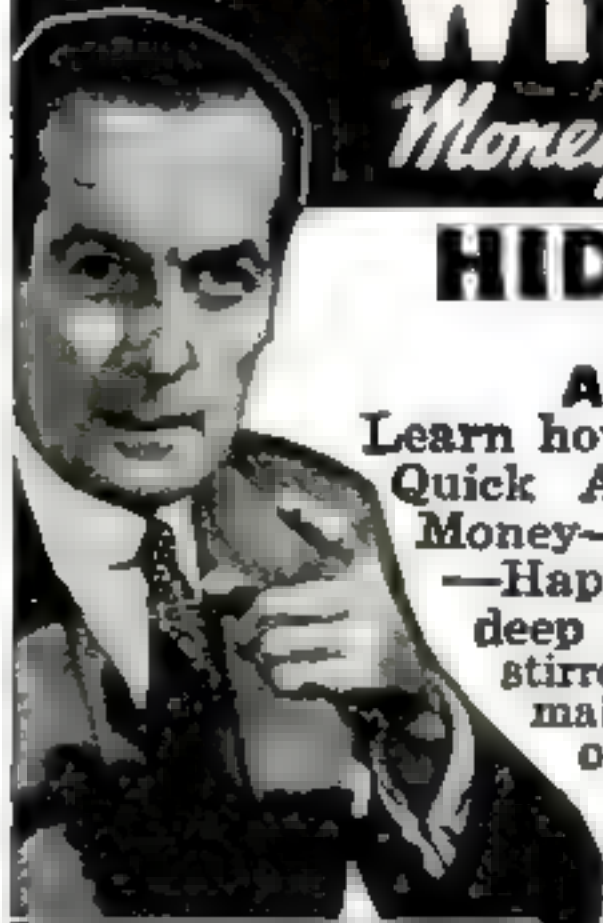
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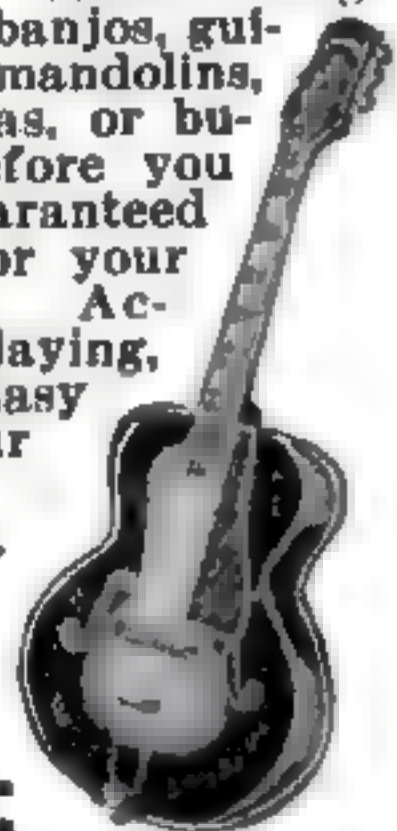
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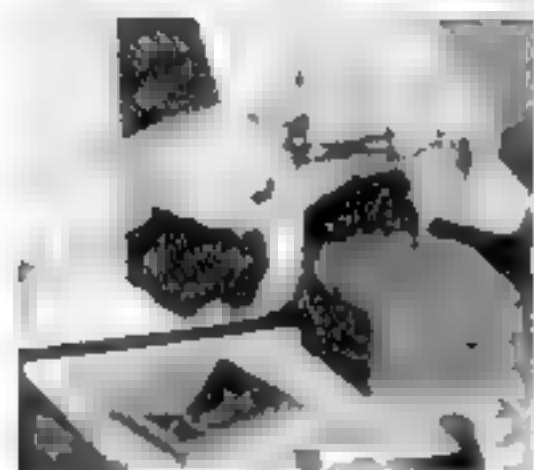
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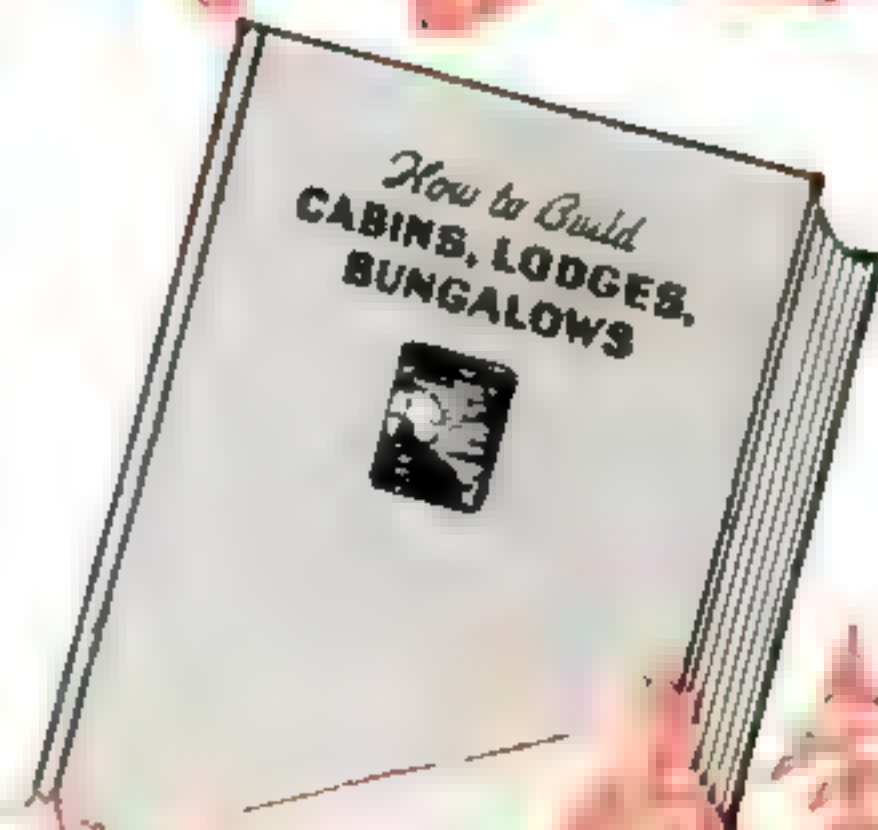
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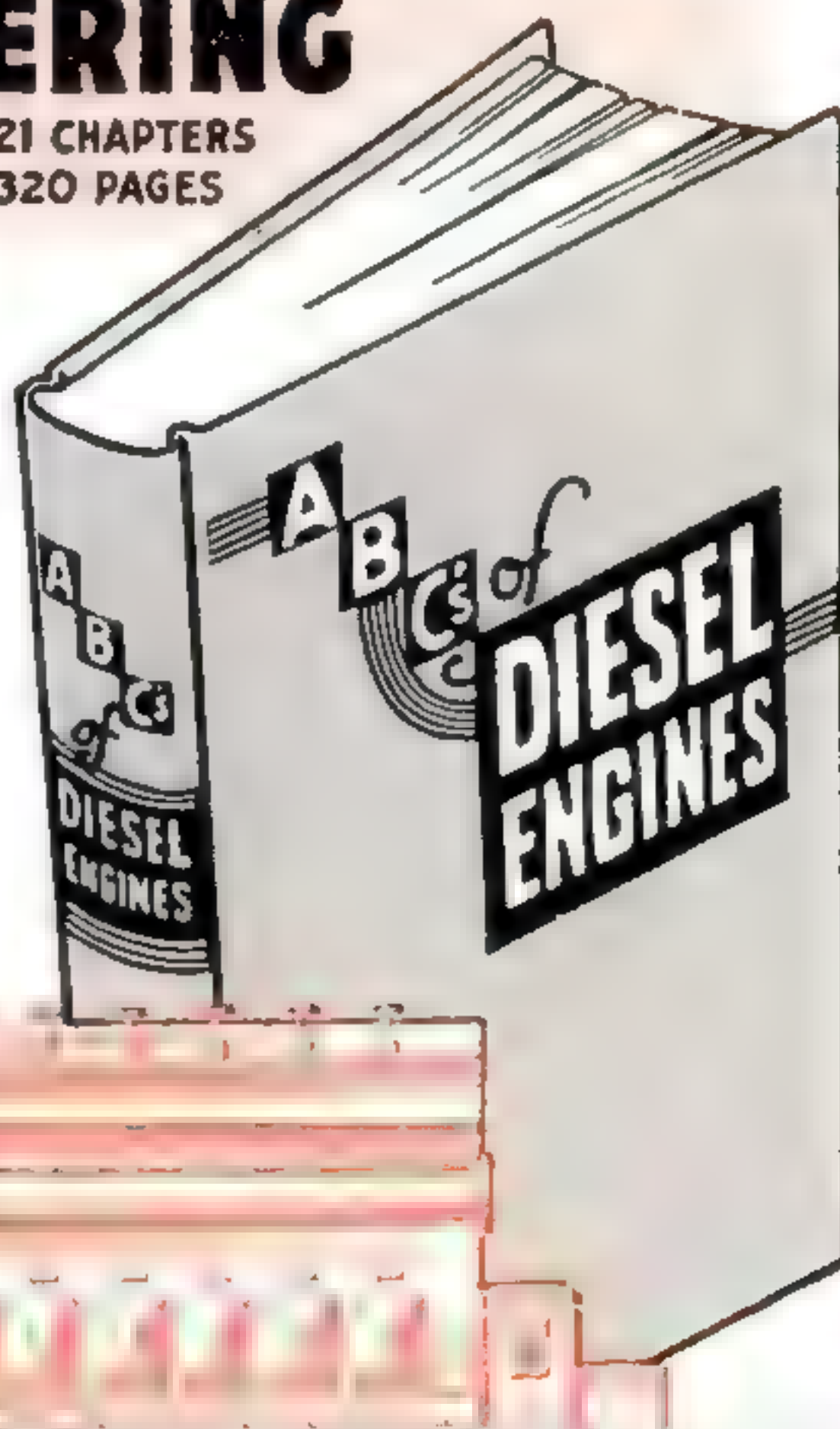
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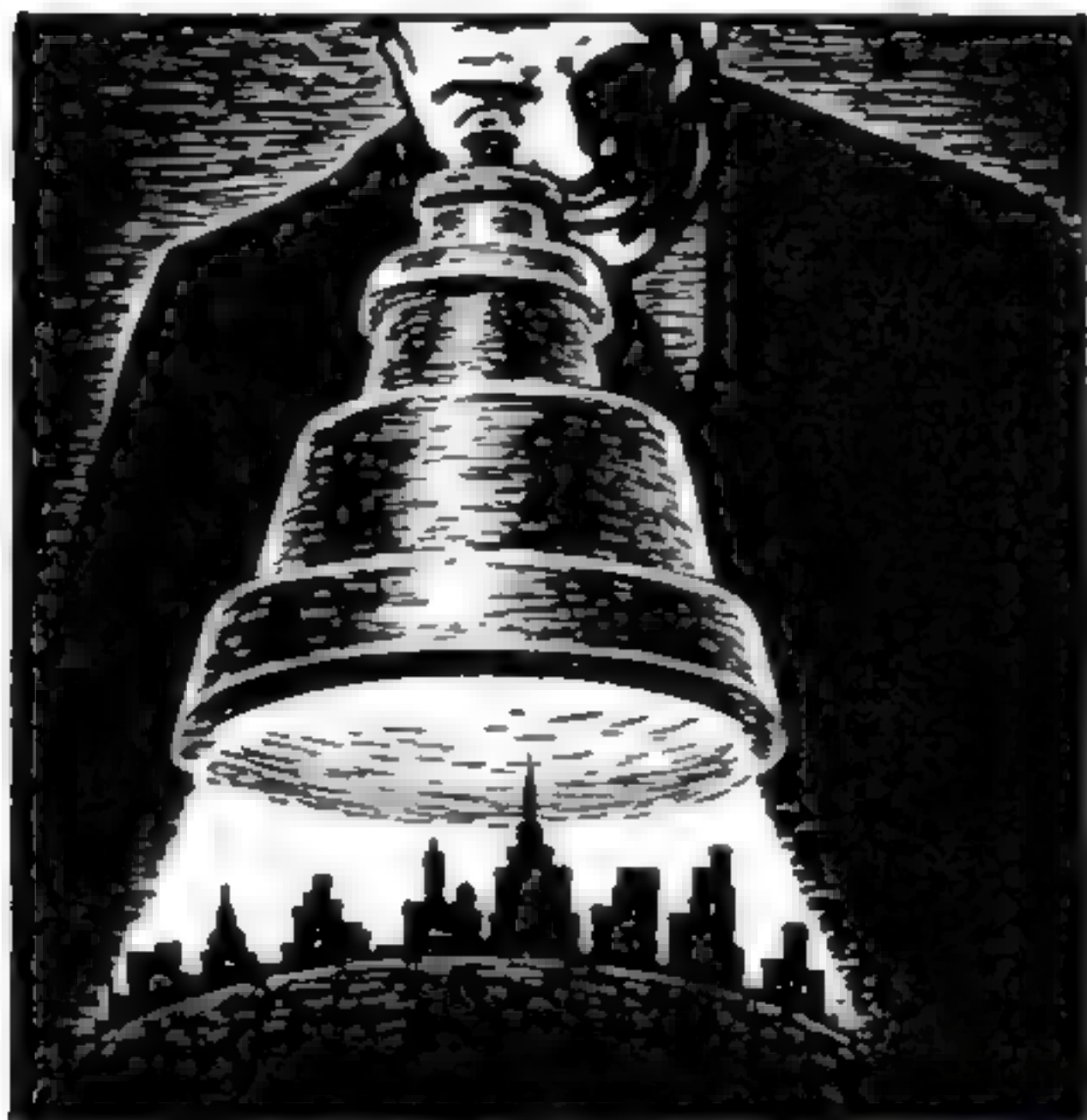
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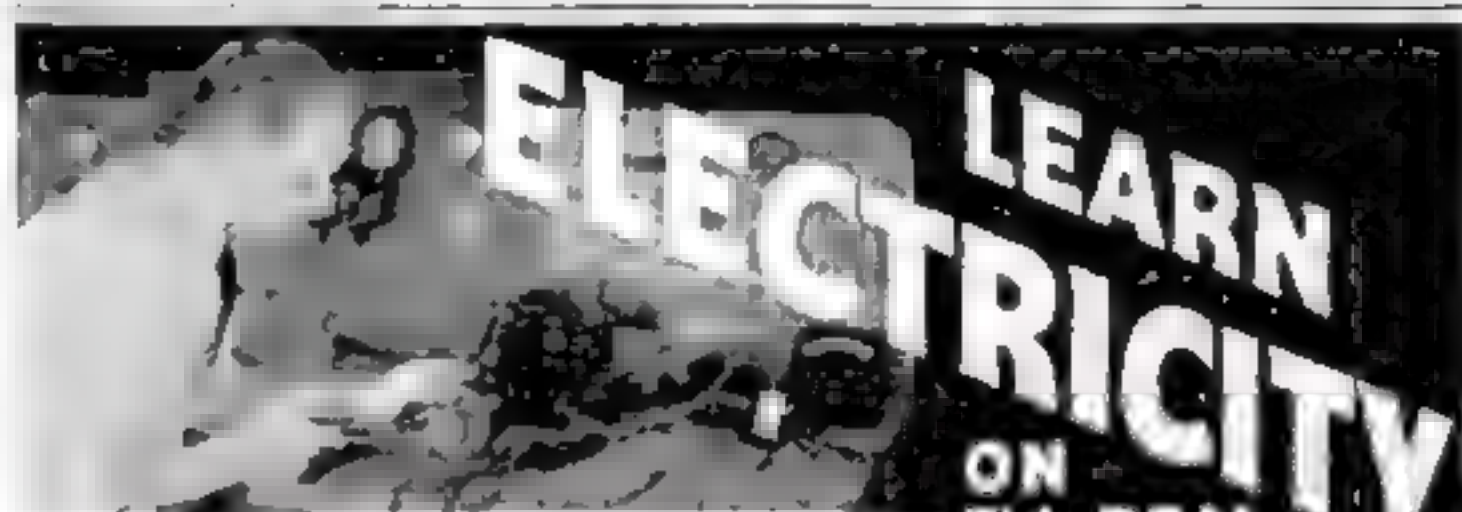
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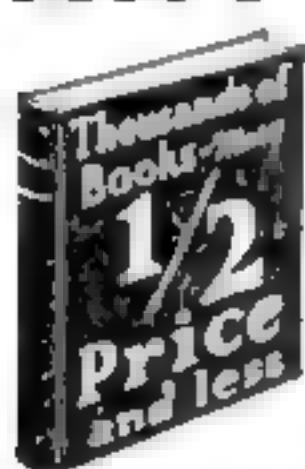
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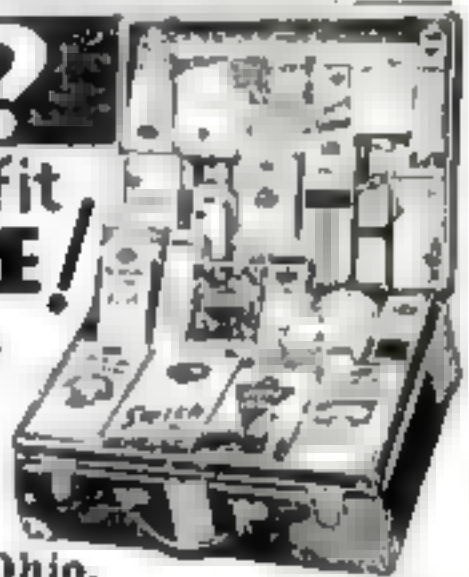
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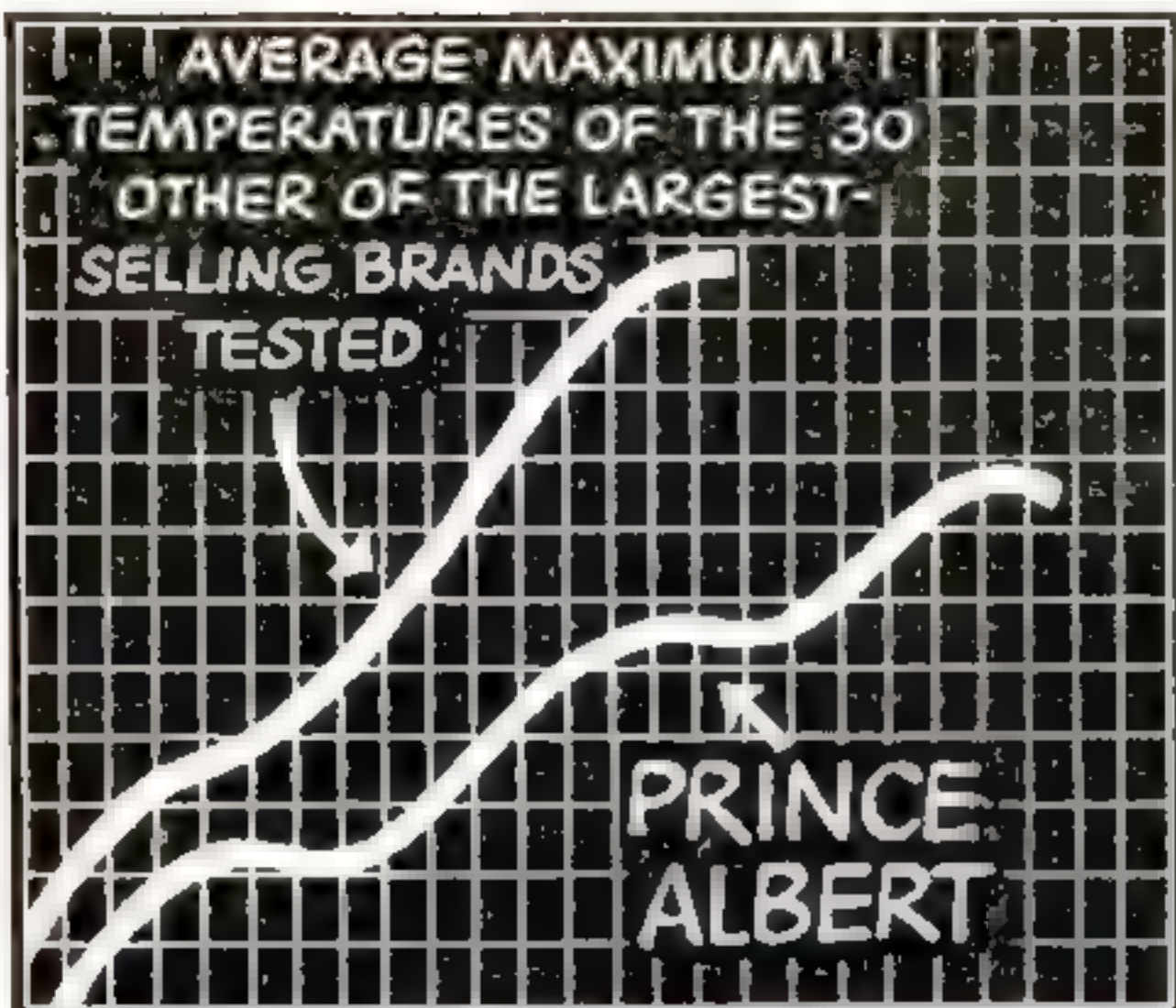


Chart showing how much cooler Prince Albert burned compared to the average of the 30 other of the largest-selling brands recently tested for cooler smoking



In Recent Laboratory "Smoking Bowl" Tests, Prince Albert Burned

86 DEGREES COOLER

than the average of the 30 other of the largest-selling brands tested —coolest of all!

SCIENTISTS at a nationally known independent laboratory tested to find the COOLEST-SMOKING TOBACCO, and the results are no surprise to millions of smokers. Automatic smoking and heat-registering machines found that Prince Albert smokes coolest—as above. Say good-bye to parching, "bitey" smokes. P.A.'s cooler, milder smoking lets rich, full body come through EXTRA EASY ON THE TONGUE. Prince Albert's choice, "no-bite" tobacco is "crimp cut." ("Makin's" fans, that's a "pointer" to you too!)

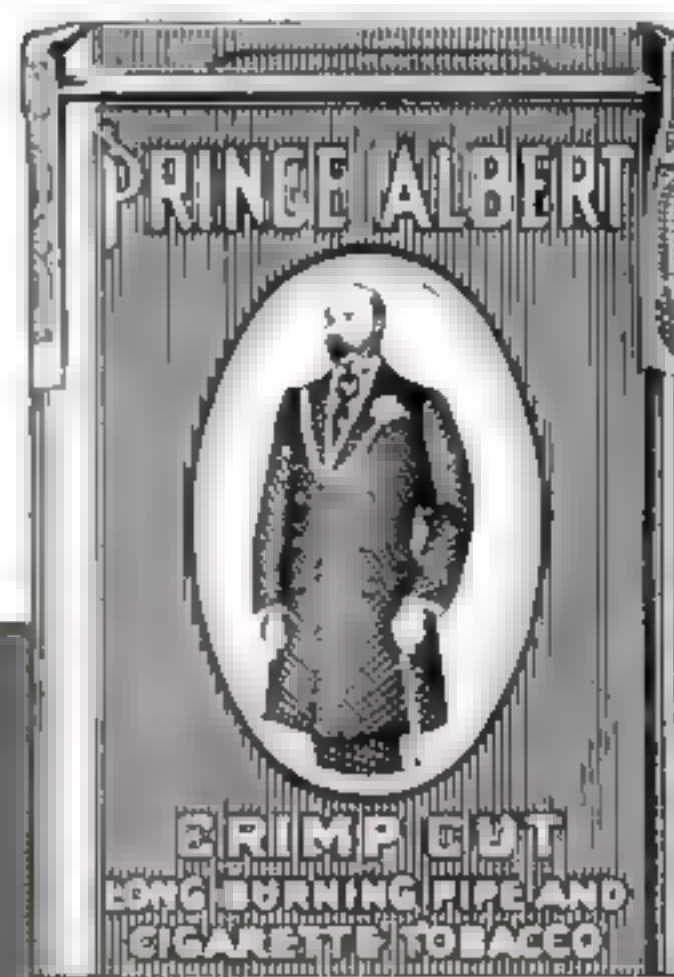
OL' JUDGE ROBBINS SAYS:



LET COOL-SMOKING P.A. PUT NEW JOY IN YOUR PIPE!

50

pipefuls of fragrant tobacco in every handy tin of Prince Albert



Copyright, 1939, R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

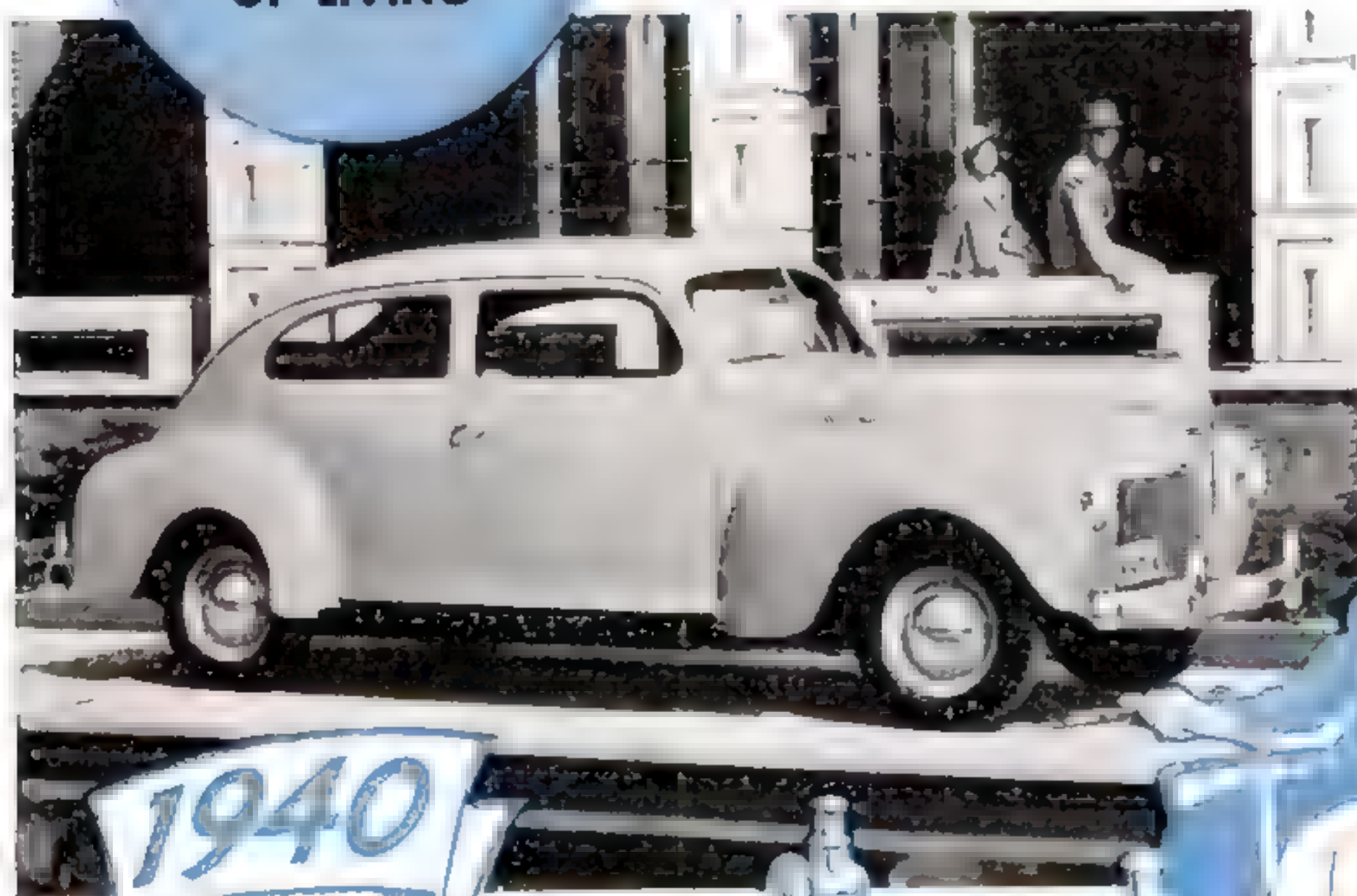
Prince Albert THE NATIONAL JOY SMOKE

Forty Years of the Automobile

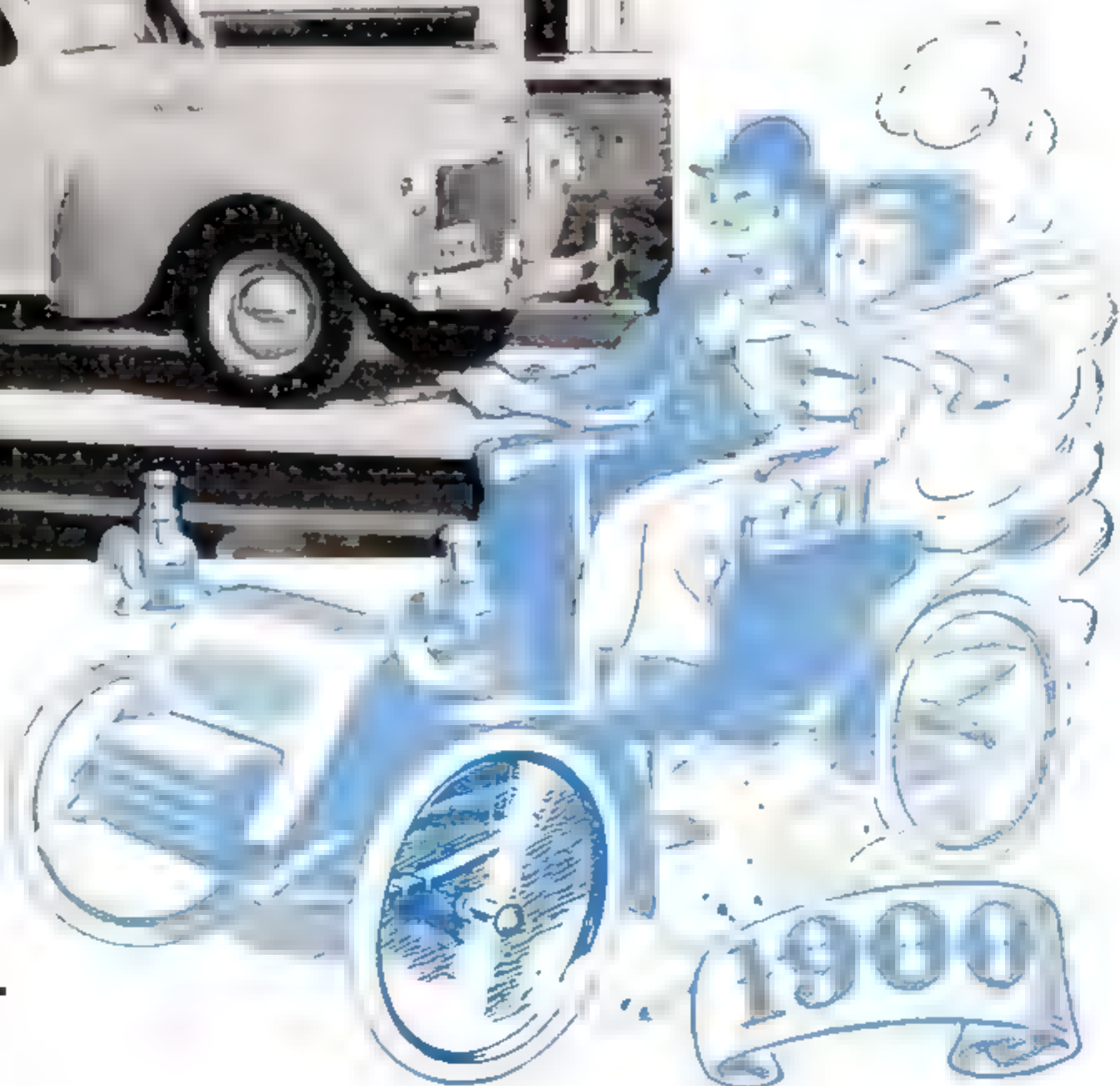
WITHIN
A GENERATION,
AN INFANT
INDUSTRY HAS
GROWN UP TO
GIANT SIZE,
PROFOUNDLY
INFLUENCING
OUR MANNER
OF LIVING

STREAMING up the steps of the Grand Central Palace in New York City a few weeks ago, eager crowds milled into the spacious exhibition halls where sleek, polished 1940-model automobiles gleamed in the glare of a thousand lights. Salesmen eagerly talked about 100-horsepower engines, dashboard styling, and the sweeping flow of fenders. Cheerfully they answered thousands of questions, but not one prospective buyer ever inquired whether a car would run or could actually be steered around a corner with perfect safety.

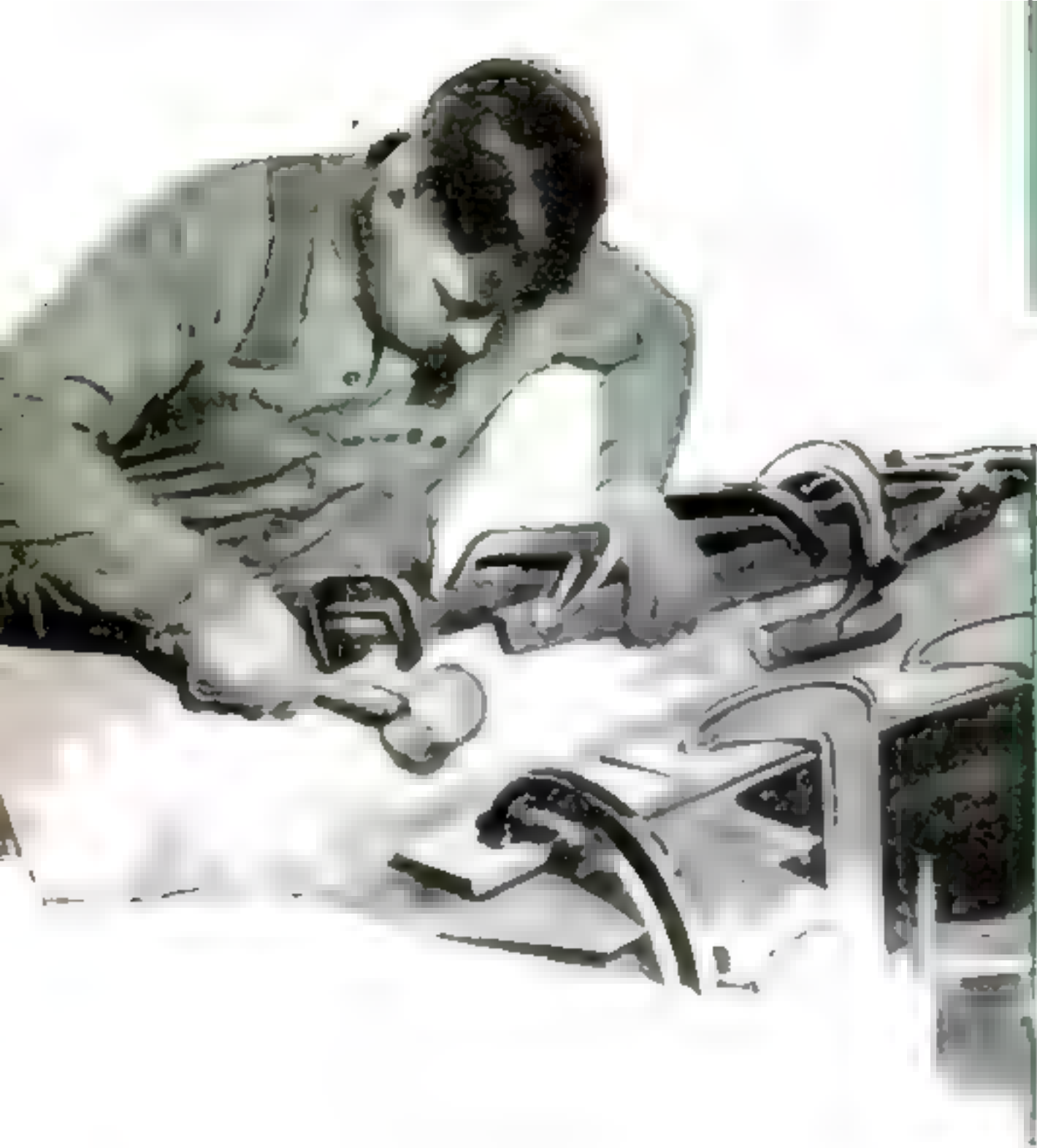
Yet, only four decades ago, those were the first questions that curious visitors asked at the first National Automobile



Then and now: It is difficult to find any family resemblance between the powerful, streamline motor car of today and its wheezy ancestor, the horseless carriage

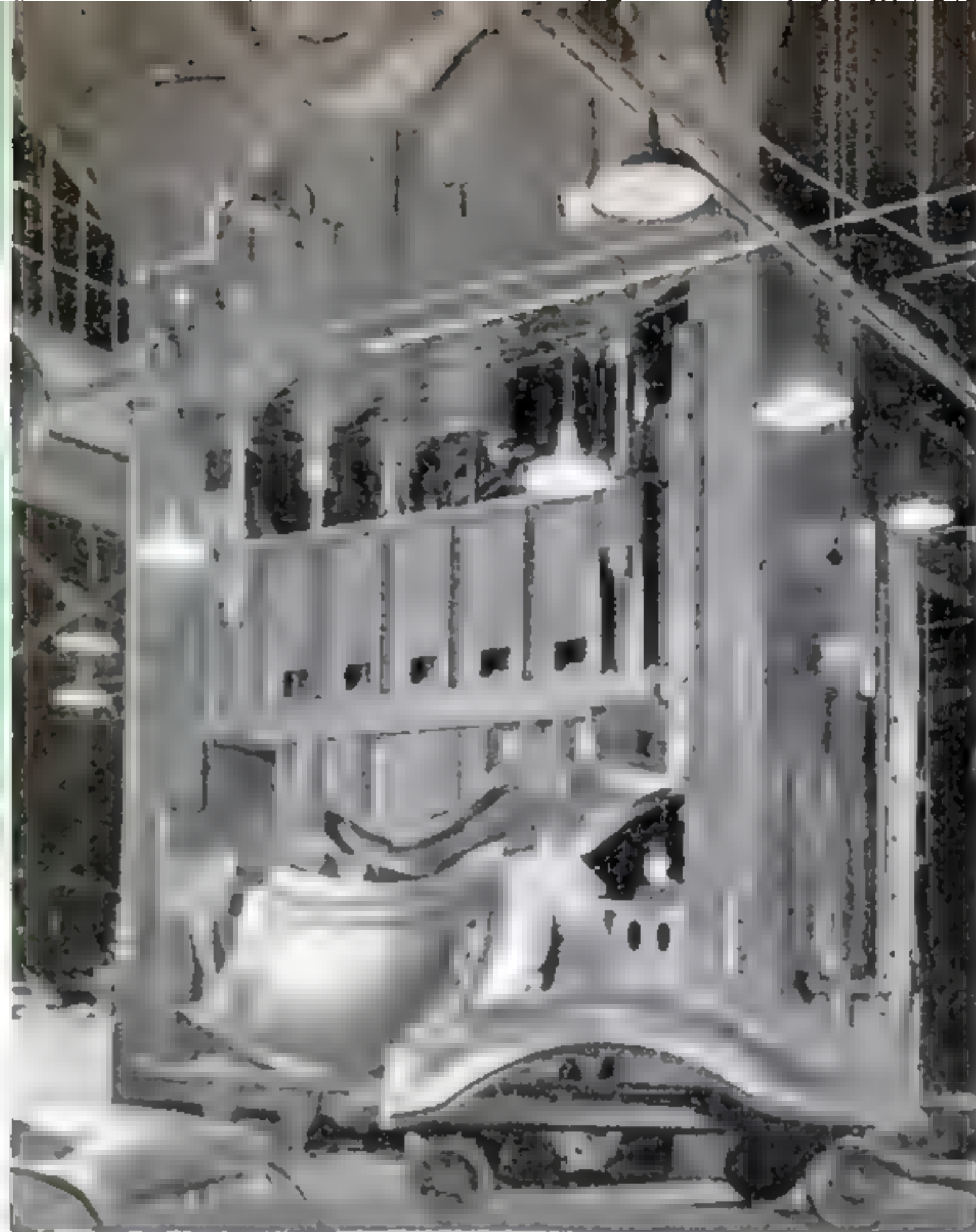


By
E. W. MURTFELDT



BODY PARTS

for early automobiles were laboriously hammered out by hand. Contrast this crude method with the press at right, which stamps out a car top at one blow



THE ASSEMBLY LINE MOVES

Assembly-line methods have been geared to ever-increasing speed. The one below turns out three cars a minute, 2,000 a day

Show which opened in New York's old Madison Square Garden on November 3, 1900. And they had to be shown. So exhibitors set up a curving lane made of parallel rows of barrels and proudly maneuvered their one-lung chariots through this hazardous course.

Today we take for granted automobile performance that would have astounded the 1900 throng that gazed in awe at the horseless carriages of that first show. Thirty-one cars were on display, and more were powered by steam or electricity than by gasoline. Packard, the



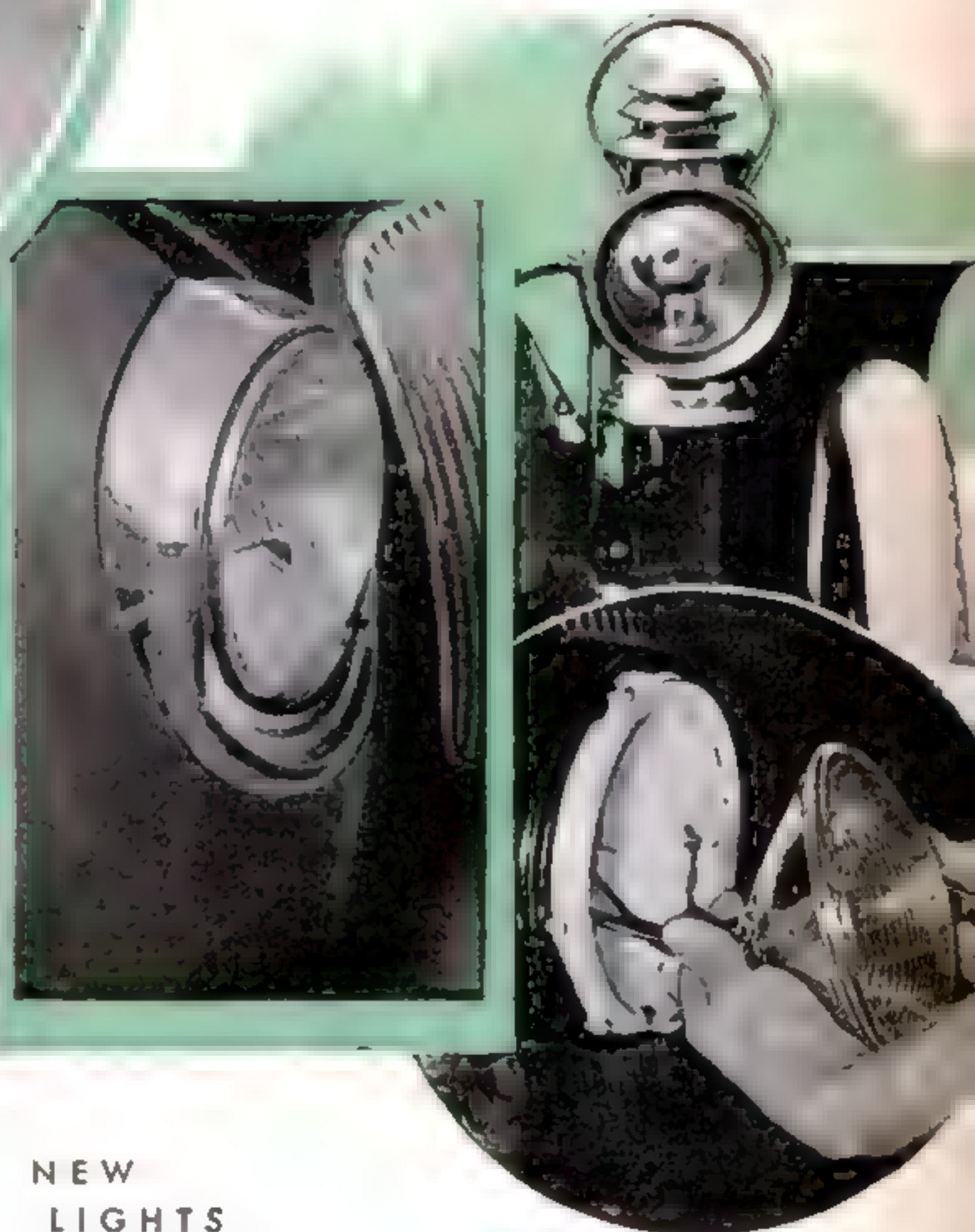


TRAFFIC congestion existed even before the automobile, as this old Chicago street scene proves. The modern highway pictured at the left illustrates how effectively engineering has met the new problems created by the motor car

only passenger car on display in both the 1900 and 1940 shows, had a snappy one-cylinder model that boasted nine horsepower and a speed ranging from seven all the way up to twenty-five miles an hour.

Around the exhibition arena, visitors were taken for a whirl along a board track to convince them that these motor buggies actually would run. And up on the roof, exhibitors had erected a board incline with steep grades up which their cars chugged fifty-three feet in fifteen seconds. Coming down, their drivers proudly demonstrated that, under the right conditions, brakes could be made to work.

None of the cars had windshields, and you steered with a tiller instead of a wheel. Some models had four wheels, and others only three. The three-wheeled Duryea had a single lever that took care of steering, changing gears, adjusting the spark, controlling the gas, and applying the brakes. Headlights were flickering oil-wick carriage



NEW LIGHTS

It's a far cry from the oil or acetylene lamps of early cars to the sealed-beam unit with reflector, lens, and bulb locked together in one dustproof and moistureproof piece, featured on many of the 1940 models



ANNUAL SHOWS

At the first automobile show, held at New York City in 1900, skeptical visitors wanted to be shown that the new gas buggies actually could turn corners, so exhibitors set up the labyrinth of barrels at the left for demonstration purposes. Below is a scene at a modern show, with a host of new models on exhibition.

lamps. Contrast this one 1900 item with the sealed-beam headlights that many of the 1940 cars have adopted. With reflector, lens, and bulb made as one integral unit, pre-focused and sealed against dust, dirt, and moisture, this new headlamp insures long life, minimum maintenance, moderate replacement cost, and a broad, extra-powerful beam that cannot blind the eyes of approaching drivers when the switch is set for "traffic."

In the year of this first automobile show, there were only 8,000 cars in the entire United States, less than the number that now pass a city corner in a couple of hours. A 1900 car that would run at thirty miles an hour for 100 yards was a racing machine. Except in and around large cities there was hardly a paved road in America. Roads through parks in Boston, Mass., were closed to motorists between ten in the morning and nine at night,

as a precaution against runaway horses. Four years before, South Dakota had a statute forbidding automobiles even to cross her boundaries.

Yet ten years or more of motoring activity had already passed before the first automobile show, a decade marked by a bitter struggle for supremacy between electric, steam, and gasoline types. Electrics had the



disadvantage of limited range, and annoying delays for battery charging. Steamers ran smoothly, but it took a long time to get steam up, and boiler leaks were frequent. Gas buggies were smelly, noisy, and complicated. Wits of the day said that with steamers it took a minute to find what was wrong and an hour to fix it, while with gasoline carriages it took an hour to find the trouble and a minute to fix it.

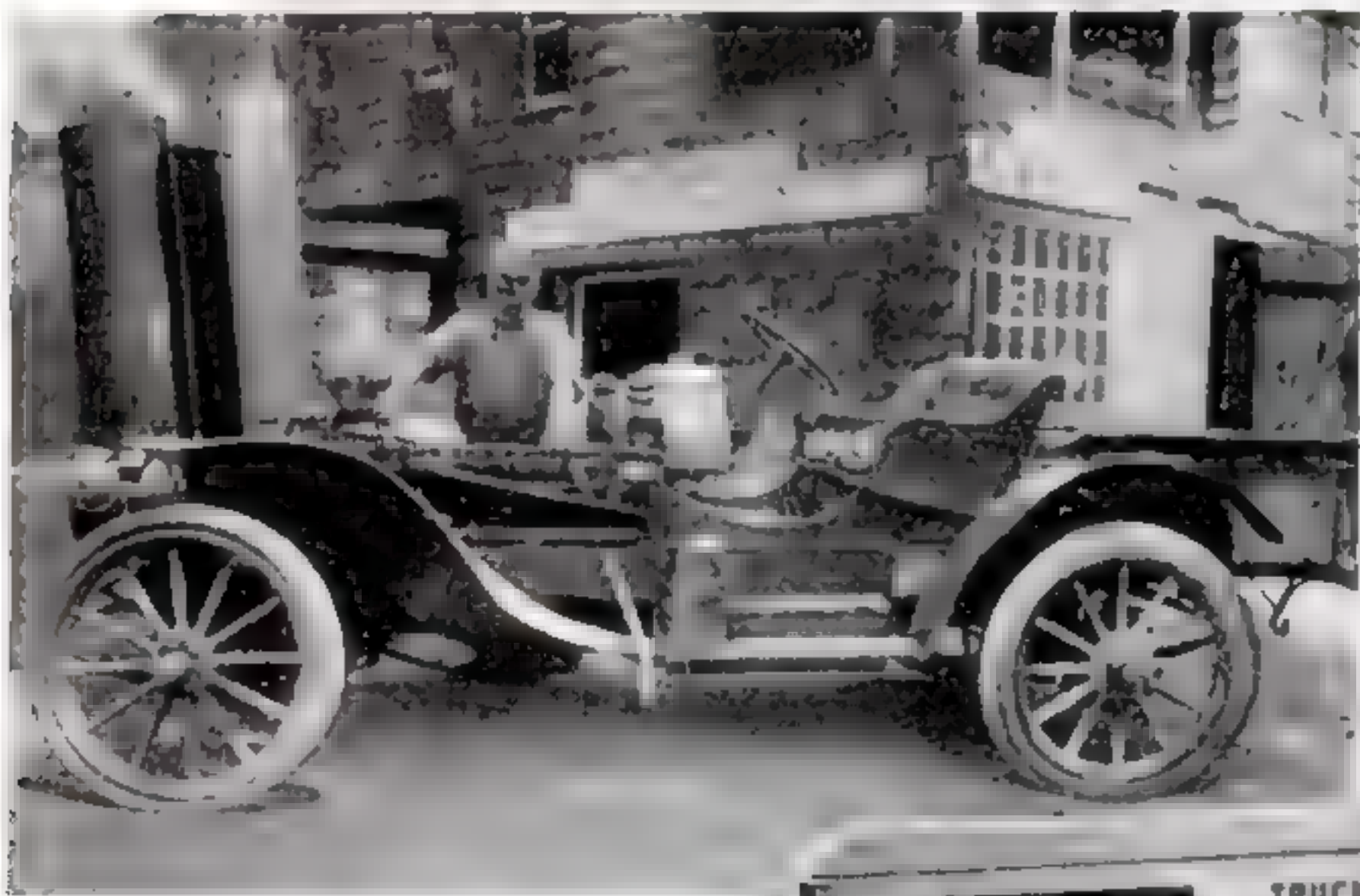
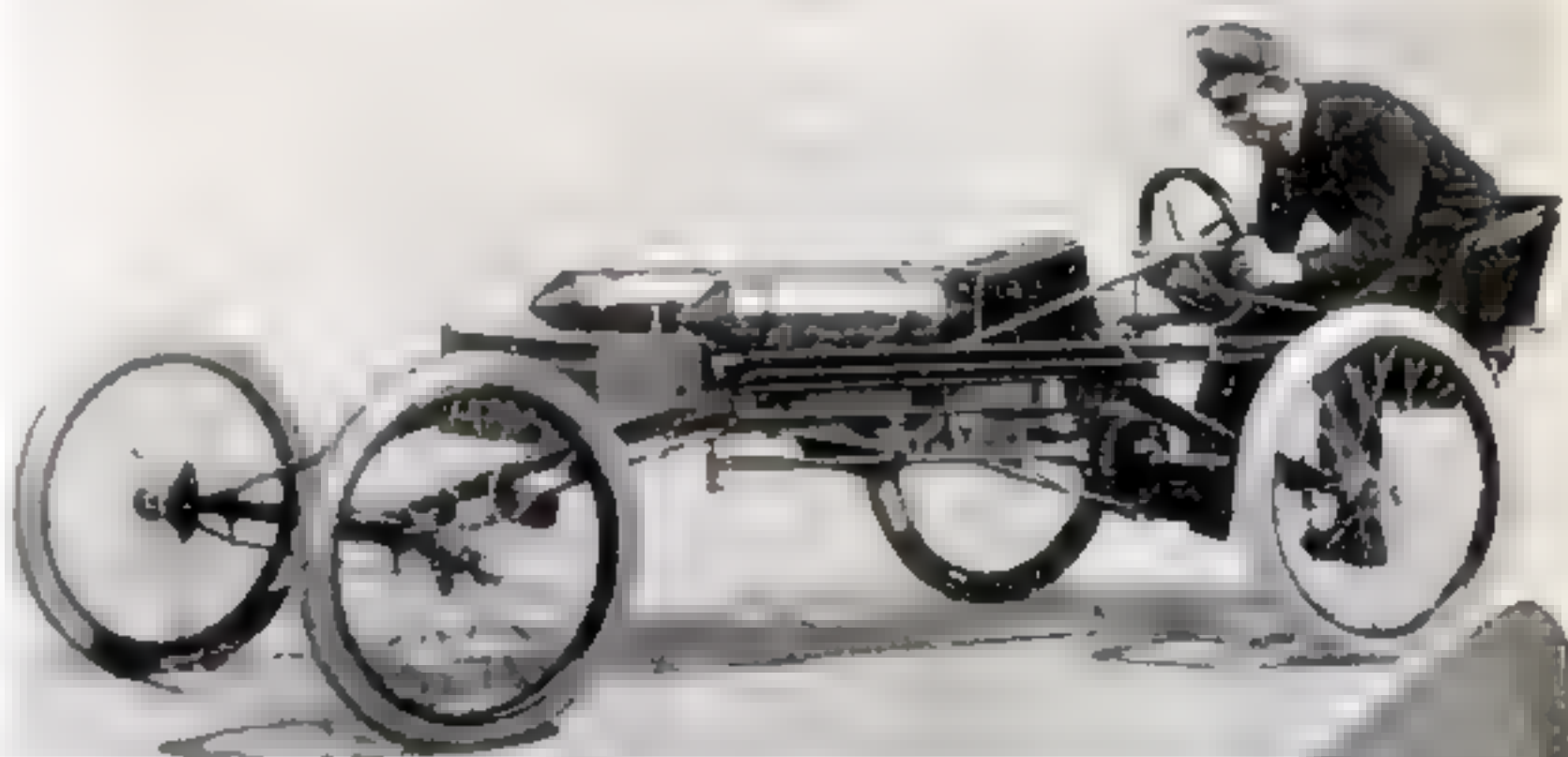
In 1891, R. E. Olds made and sold his first steam-propelled car, and the following year Charles E. Duryea turned out America's first gas-powered car. Modeled on the horse-drawn buggy, the body of this car was fitted with a whip

socket. A Duryea car in 1895 won the first automobile race in the United States, a fifty-two-mile run over a muddy Chicago, Ill., course. Winning time: seven hours, thirty minutes.

By the turn of the century and the first automobile show, the motor car had established itself and started to forge ahead. Some of the land- (Continued on page 241)

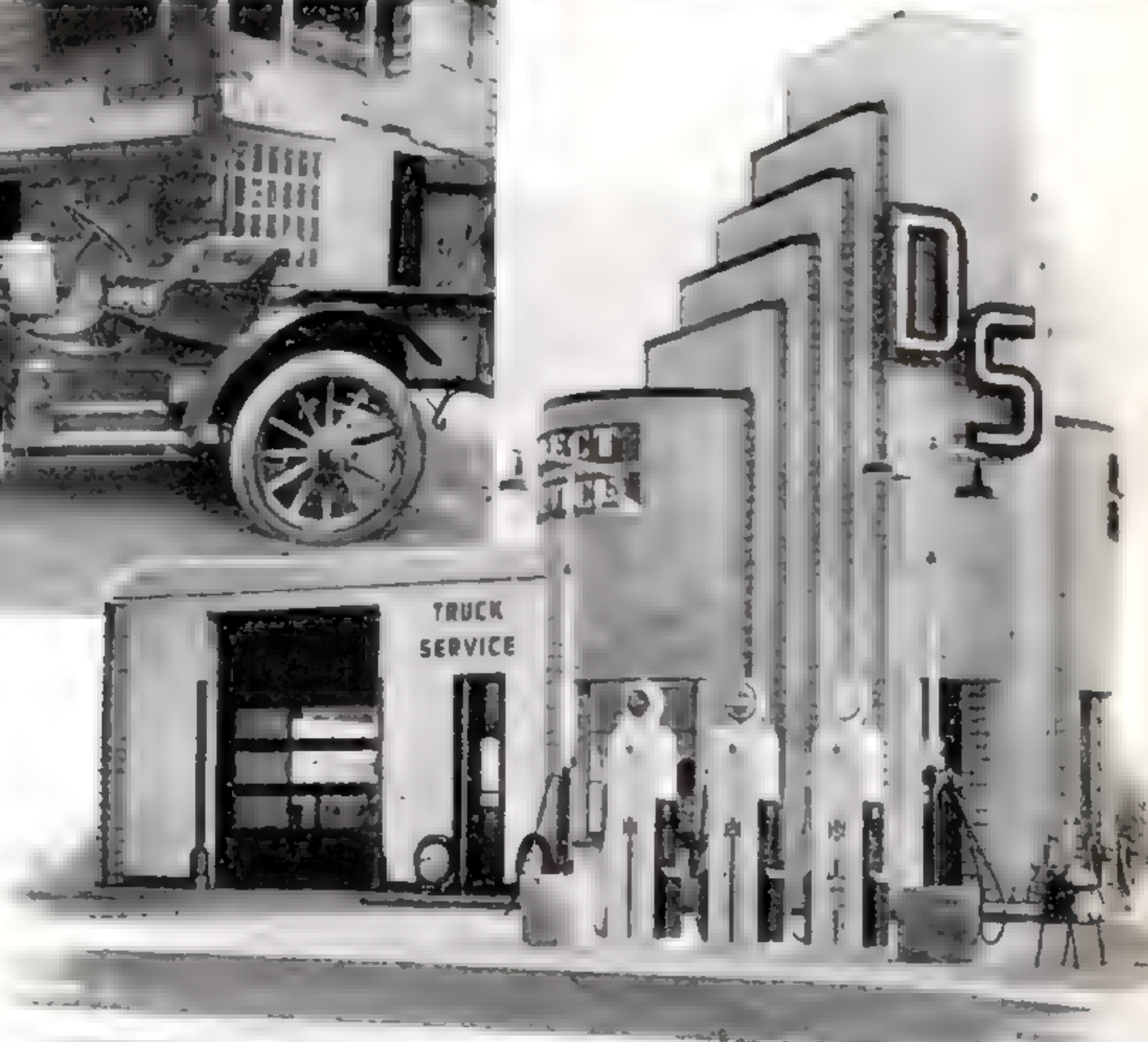
RACING CARS

Among the early speed drivers was R. E. Olds, seen at the right steering his *Pirate* over the sands at Daytona Beach, Fla. A modern racer, Capt. G. E. T. Eyston's *Thunderbolt*, is below



SERVICE STATIONS

Early motorists bought their gasoline and oil at drug and hardware stores, or at roadside garages like the one seen above. Right, a service station of today, with glass walls

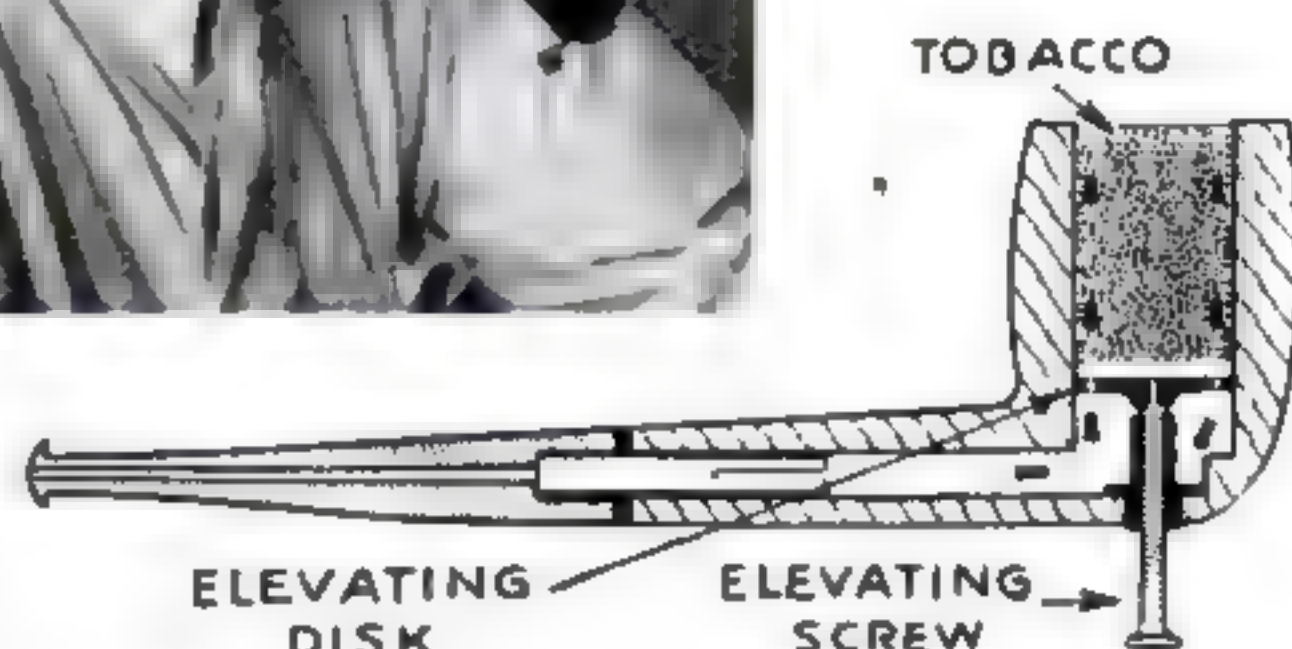


Stoker Pipe for Smokers Saves Matches, Tobacco

BY ADDING a perforated metal disk, attached to an elevating screw, to the bowl of an ordinary smoking pipe, Harold T. Blum, of Millersburg, Ohio, has devised a pipe operating on a new principle. It is filled and lighted in the ordinary way. Then, from time to time, the elevating screw is given a turn, pushing the tobacco upward. This "stoker action," according to the inventor, eliminates the necessity of relighting a pipe and produces a saving of more than thirty percent on tobacco. It is also said to prevent the formation of a soggy "heel" in the bottom of the pipe bowl.

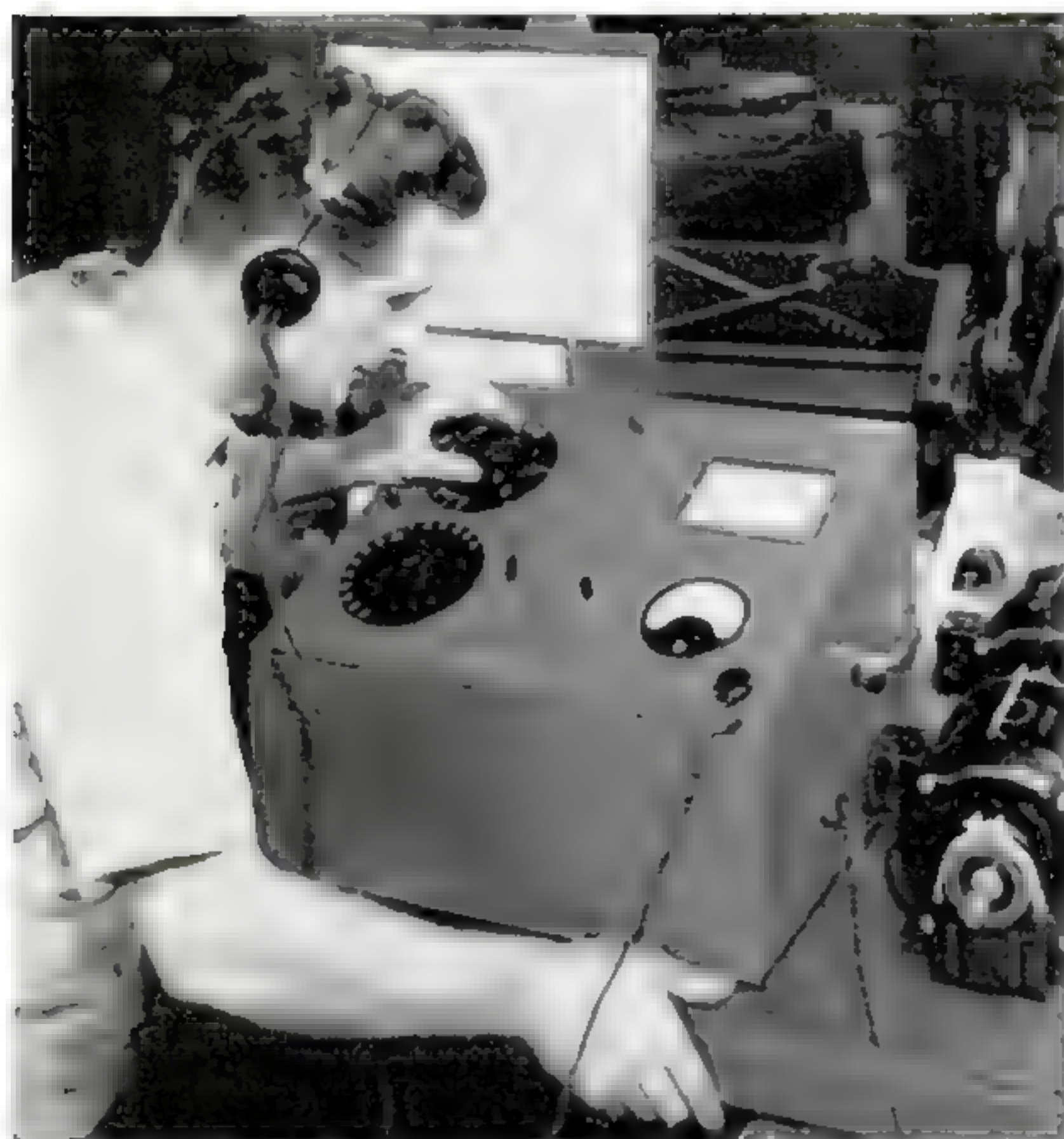


Turning the screw on this novel pipe pushes the tobacco upward as it burns down from the top



"Electrical Ears" Test Machines

ELECTRICAL ears, tuned in to catch faint sounds that indicate flaws in finished products, are now being used in American factories. Deaf to all sounds except the particular squeak or rattle they are set to pick up, such "industrial noise analyzers" can be used to warn assembly-line inspectors of defective motors or similar machines. Even containers can be tested with the electrical ears. A manufacturer of canned goods found that pellets of lead sometimes fell inside when the cans were being sealed. A special "ear" designed for him picks up the sound of a lead pellet rattling in a can. With the "noise analyzer" attached to the production line, all cans giving off the telltale noise are automatically discarded.



An inspector listening for sounds that reveal flaws in motors

Protractor Marks Lines for Welding Joints

ELIMINATING the necessity of making complicated templates, a new protractor simplifies the work of marking pipes for cutting in preparation for welding joints. To determine the angle at which the cut is to be made, the user sets an indicator on a 180-degree scale. Then a flexible arm, holding chalk or crayon, is moved until a guiding line has been produced, showing the exact angle at which the pipe should be cut to make the desired welded joint.

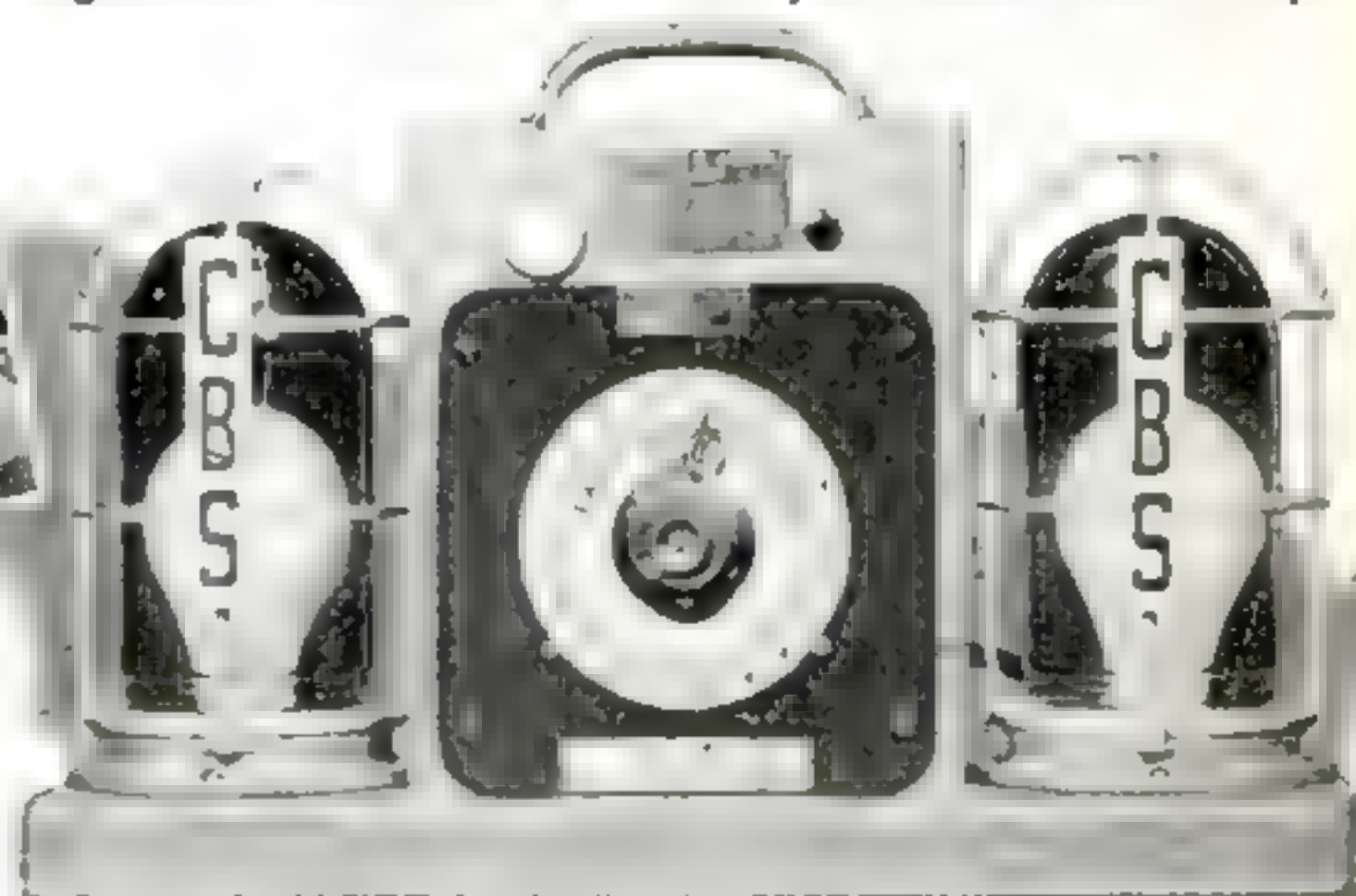




Nerve center of the CBS war-news bureau. Arrow points to the device pictured below, which flashes lights to warn the news analysts when time is up



Three powerful receivers operated by this technician gather the short-wave signals from Europe



How Radio Gathers the War News

TO PROVIDE radio listeners with the most efficient coverage of war news, from all fronts, the Columbia Broadcasting System is now operating a specially designed studio in New York City that serves as a nerve center for news. From the middle of the studio, announcers at the microphone table can look through a plate-glass window in one wall into the office of the director of the network's news service; through a second wall window into the news room where a staff is receiving and editing late news bulletins; through a third to the master control booth; and through a fourth

to a soundproof listening room where a corps of linguists listen to and interpret incoming short-wave programs from stations all over the world. In a small shack a few miles away on Long Island, a technician is in charge of three powerful receivers. While he is monitoring one program into the New York headquarters, he twirls dials on the other receivers to find another station with additional important news. A special silent timing device, pictured above, blinks brilliant photoflood bulbs to warn announcers and news analysts that the end of a news period is at hand.



As the girl copies given words, the device plays a tune

It Types Out Tunes Instead of Words

IF YOU can operate a typewriter, it should be the easiest thing in the world to play a novel musical instrument recently invented by Alexander Rose, a court reporter in the Borough of the Bronx, New York City. Resembling a small portable typewriter in appearance, the novel instrument is played by typing out words on keys, following a written score in the form of words inscribed on a sheet of paper, thus eliminating the necessity of learning to read musical notation. The keys of the instrument strike strings inside, and the tone produced resembles that of a zither. How the instrument is used to type out a tune is being demonstrated in the photograph at the left.

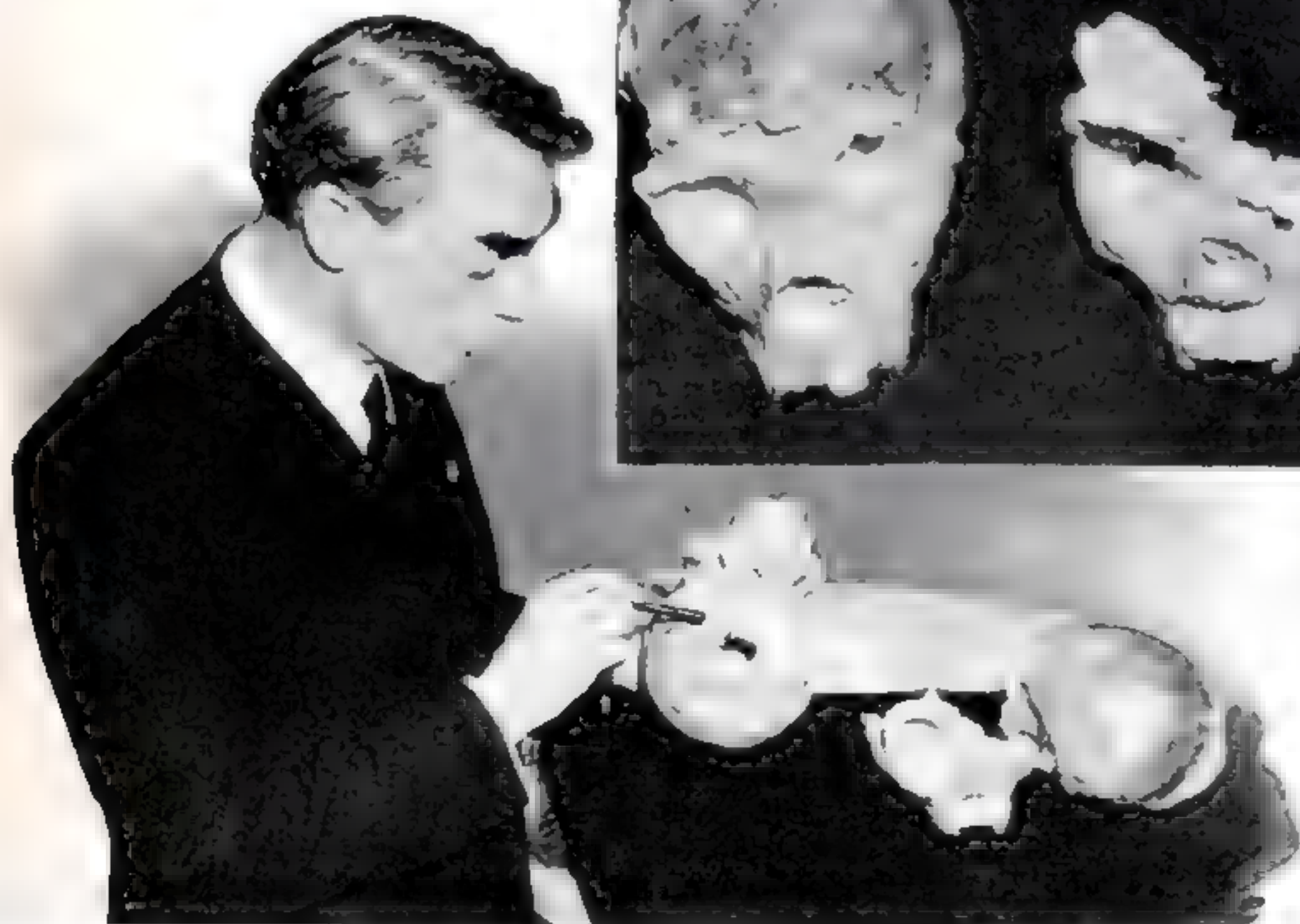
Skull Throws New Light on Ancient Man

CALLED the most perfectly preserved specimen of its kind in the world, the skull of a Neanderthal man, member of a race that inhabited the earth many centuries ago, was discovered recently on an altar in a cave at Monte Circeo, an Italian seaside resort some fifty miles from Rome. The surface of the skull showed that its owner had met death by repeated blows from a club, and the place where it was found led anthropologists to believe that it

may have been used in some sort of religious rite. This discovery, it is said, enabled Prof. Sergio Sergi, head of the Institute of Anthropology at the Royal University of Rome, further to establish his theory that Neanderthal man walked erect and not in the stooped posture of such creatures as the gorilla or the orang-utan, primates that still inhabit parts of the world.



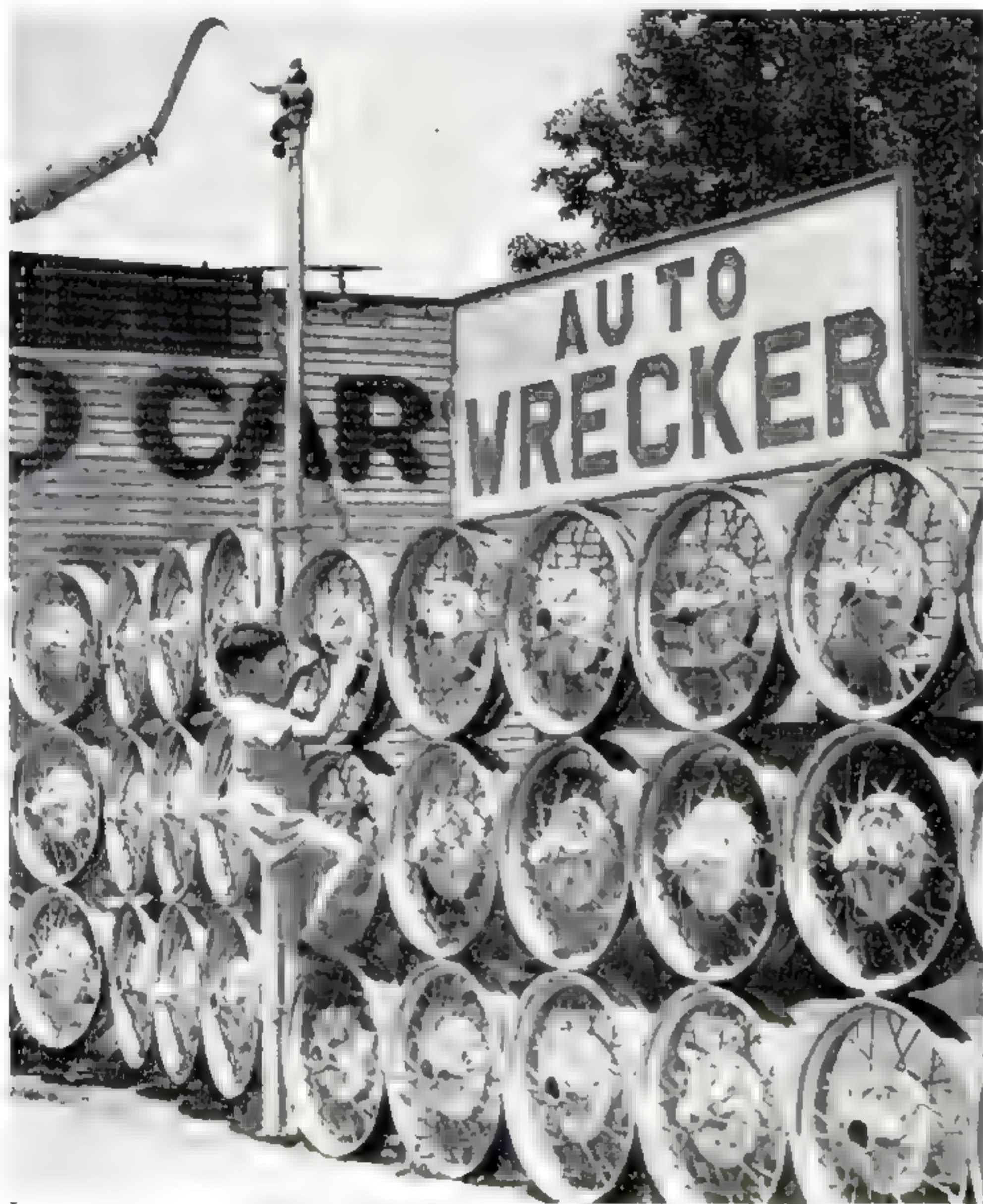
At the right is the newly found skull of a Neanderthal man, the most perfectly preserved specimen of its kind ever discovered



Prof. Sergio Sergi, anthropologist, examining the base of the skull which proved to him that its owner walked erect

Auto-Wheel Fence for Used-Car Lot

OLD wire wheels, salvaged from junked automobiles, are welded together to form a novel fence around a used-car lot in San Jose, Calif., which also boasts a gateway whose hinge posts consist of upright automobile drive shafts, connected at their tops by a muffler and exhaust pipe.



Welded together, these old wheels make an appropriate fence for a car lot

New Rotary Bins Save Time, Space

MOUNTED one above the other on a central vertical shaft, shelves containing compartments of various sizes for tools and machine parts can be revolved to make their contents quickly available. A typical example of the advantage of the rotating parts shelves over stationary types, the manufacturer claims, occurred in a Detroit, Mich., automobile plant where the device doubled the speed of serving parts to men.



Each layer of bins turns to display its assorted tools and parts



Shoulder Shrug "Laces" Corset of New Design

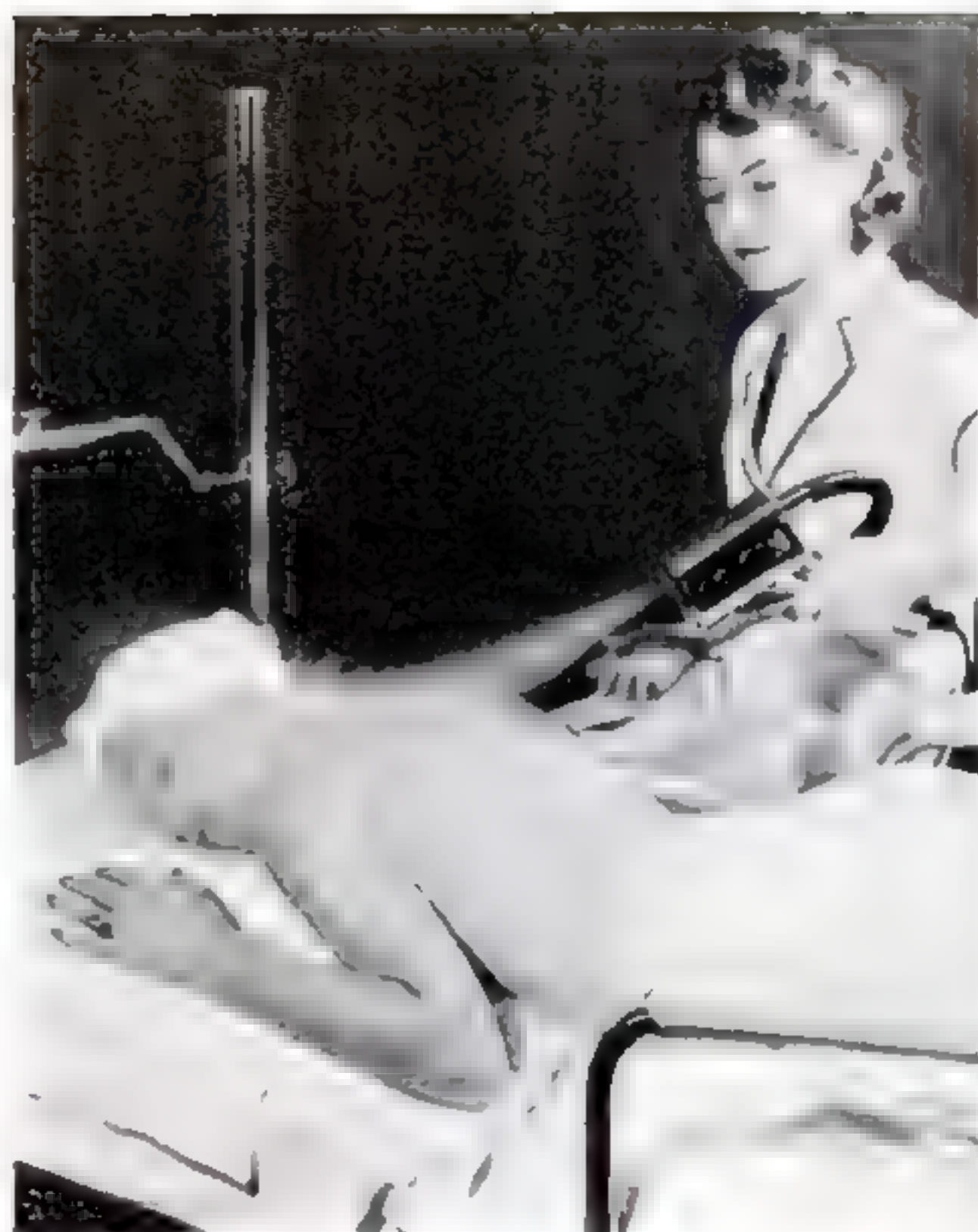
A SHRUG of the shoulders is all that is required to tighten a corset fitted with a novel automatic slide fastener now available. Raising the shoulders exerts a tug on the corset shoulder straps which in turn pull the slide fastener upward to close it.

Beauty "Gun" Fires Ozone To Tone Up the Skin

BOMBARDING the skin and scalp with a vapor shot from a gun is a new type of beauty treatment that is said to cleanse and tone up the skin. The vapor, consisting of steam and active oxygen, or ozone, produced by an electric arc, is sprayed into the hair to treat the scalp, or over the skin, as shown in the illustrations below and at the right.



A pistol grip helps direct the ozone stream onto the scalp

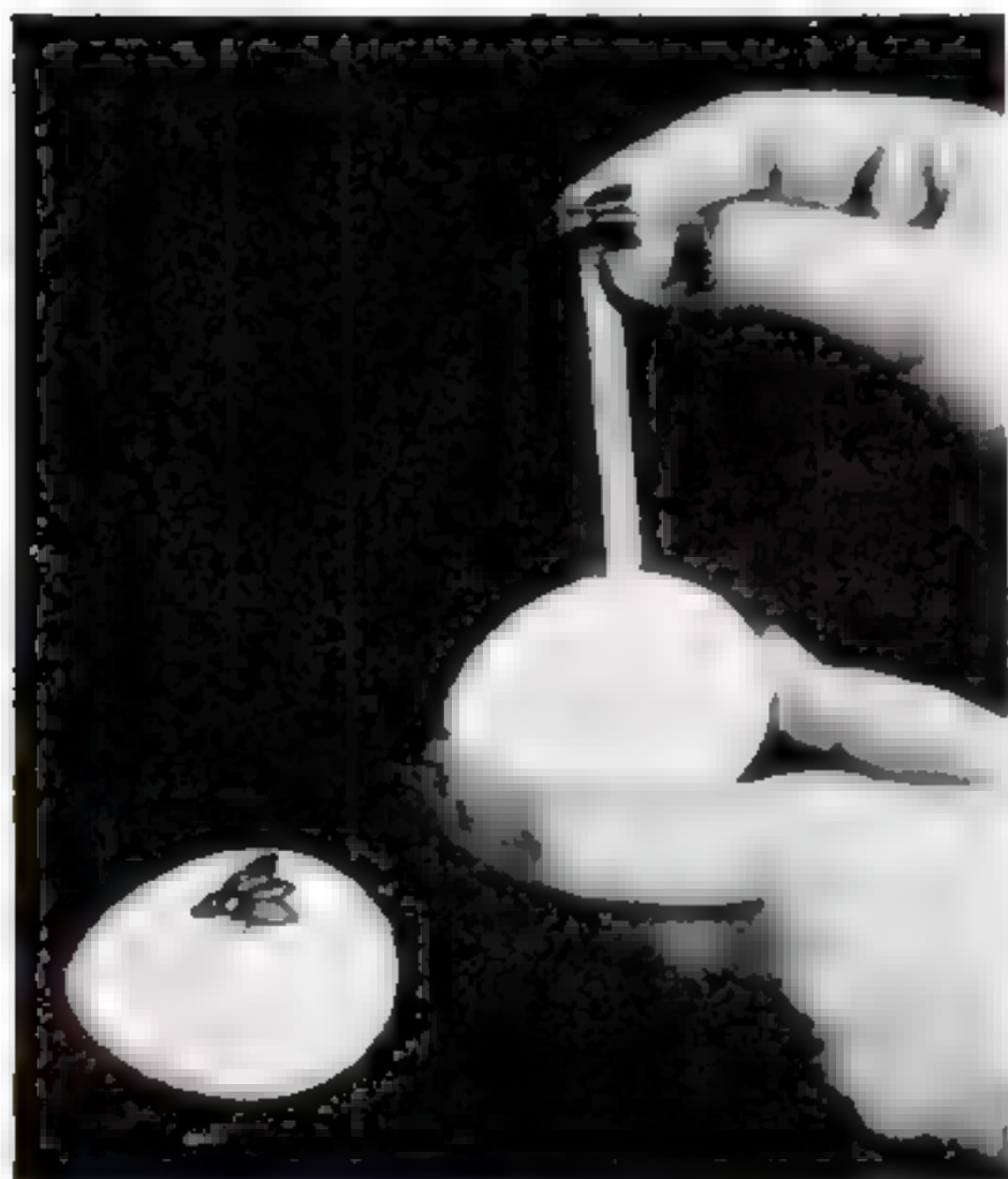


A beauty-shop client getting a skin treatment with the ozone-discharging apparatus

Broken Glass Is Good for Chicks

BROKEN GLASS, which keeps its cutting edges many times longer than pebbles, is by far the most effective form of grit a chicken can have in its gizzard for grinding up and deriving most nourishment from its food, according to Dr. George S. Oliver, Los Angeles, Calif., agricultural scientist.

Fly on Egg Is Tape Measure



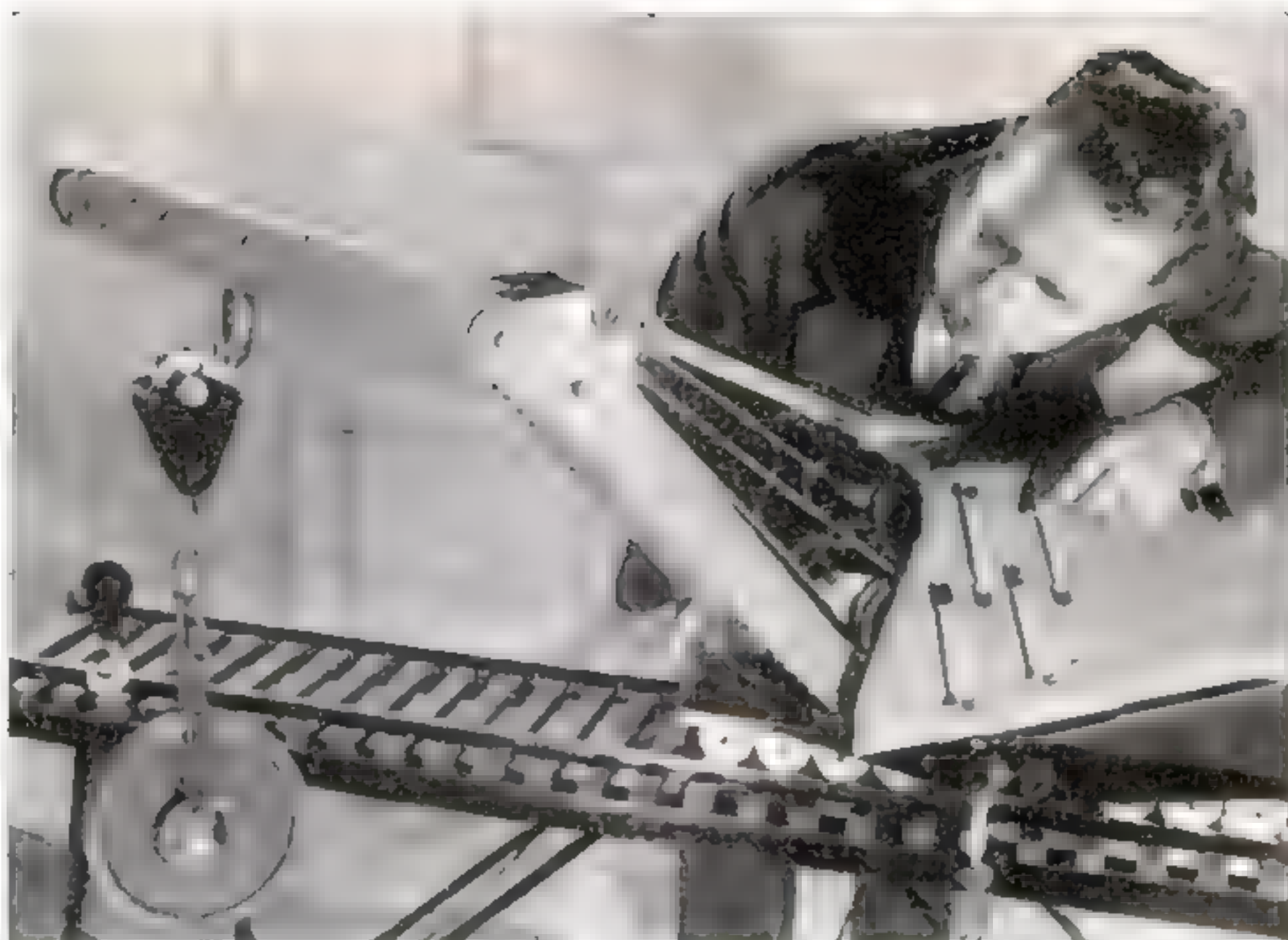
ALTHOUGH at first glance it appears to be only a house fly perched on a hen's egg, the novelty pictured at the left is actually a handy tape measure. Pulling out the artificial leather fly unreels the tape measure from a drum inside the painted steel egg. A spring automatically winds up the tape when the egg is up-ended and the fly is released.



Glass and pebbles (top) taken from a chicken gizzard. Glass is still sharp

Realistic Model Railroad Crane

BUILT to a scale of one inch to the foot, a remarkable working model of a railroad wrecking crane designed and constructed by Aaron F. Scoblic, of Milwaukee, Wis., will lift more than double its own weight of 155 pounds. Powered by a quarter-horsepower electric motor, the crane is operated from the side of the revolving cab by means of four control levers, each of which has a forward, neutral, and reverse position.



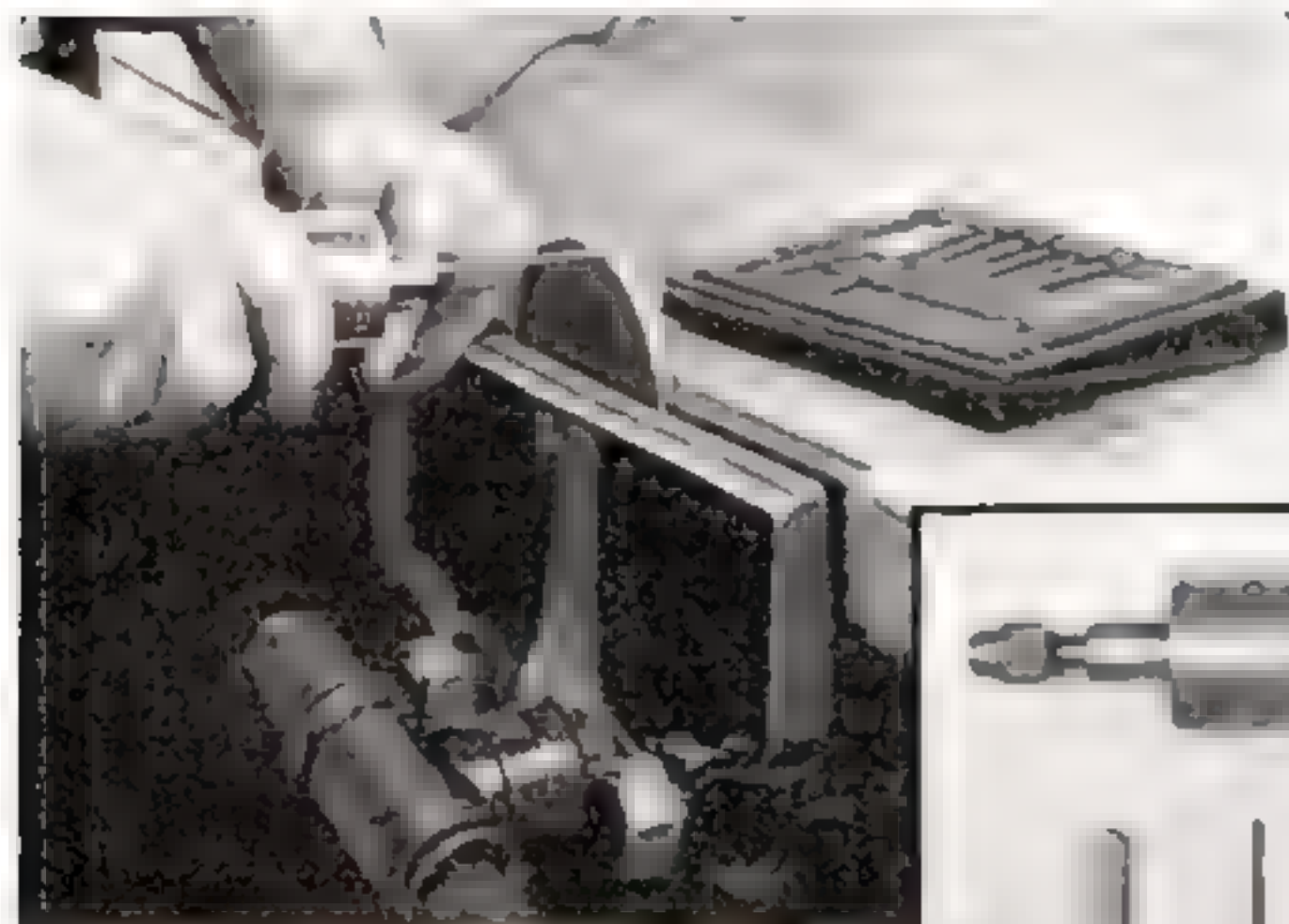
This 155-pound model railroad crane will lift double its own weight

Railroad Cattle Crossings Get Telephones



A farmer phoning to learn if it is safe to drive cattle across tracks

FARMERS drive their cattle over railroad crossings with complete safety by using a novel system recently established. Using a telephone installed near the crossing gate, the farmer calls the railroad signal man and ascertains if near-by track sections are free of approaching trains. If they are, he opens the gates, drives the cattle across, closes the gates, and then calls the signal man from the phone on the opposite side of the track, to report all clear.

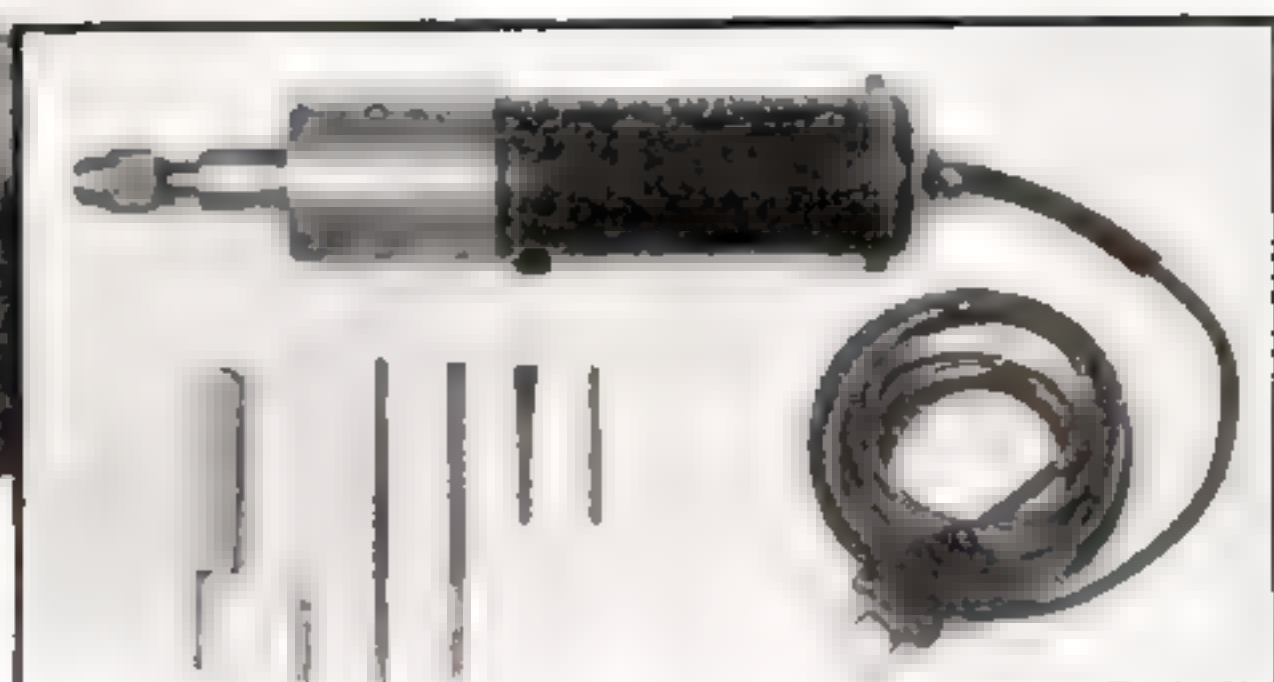


How the power tool can be used for filing. At right, the complete unit with its accessories

New Electric Hand Tool

OPERATING with a reciprocating movement, a new workshop power tool will chip, saw, file, burr, and hone, performing many jobs such as die sinking, and pattern, tool,

and plastic-mold making. Powered by a 110-volt universal motor, the tool weighs only one pound. It is available in models having 7/16-inch or 1/8-inch stroke.



"Sweet Potato" Factory



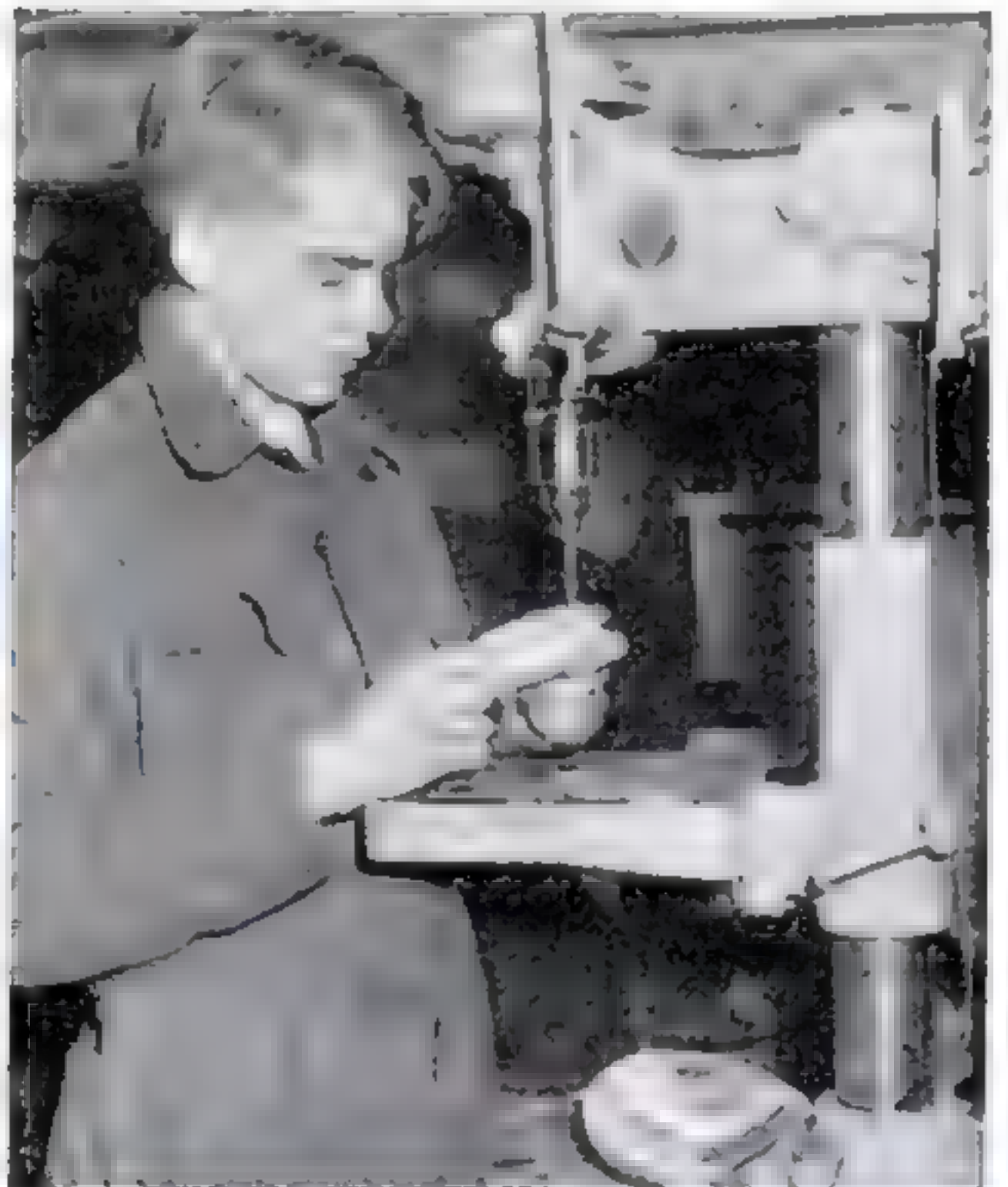
Oliver Engebretson, one of the three boy ocarina manufacturers, cutting sections from quarter-inch sheets of walnut, mahogany, and maple on a jig saw



With his two partners, Stewart Sumner and Richard Fjellman, he joins the wood laminations with waterproof glue and leaves them in clamps for two days

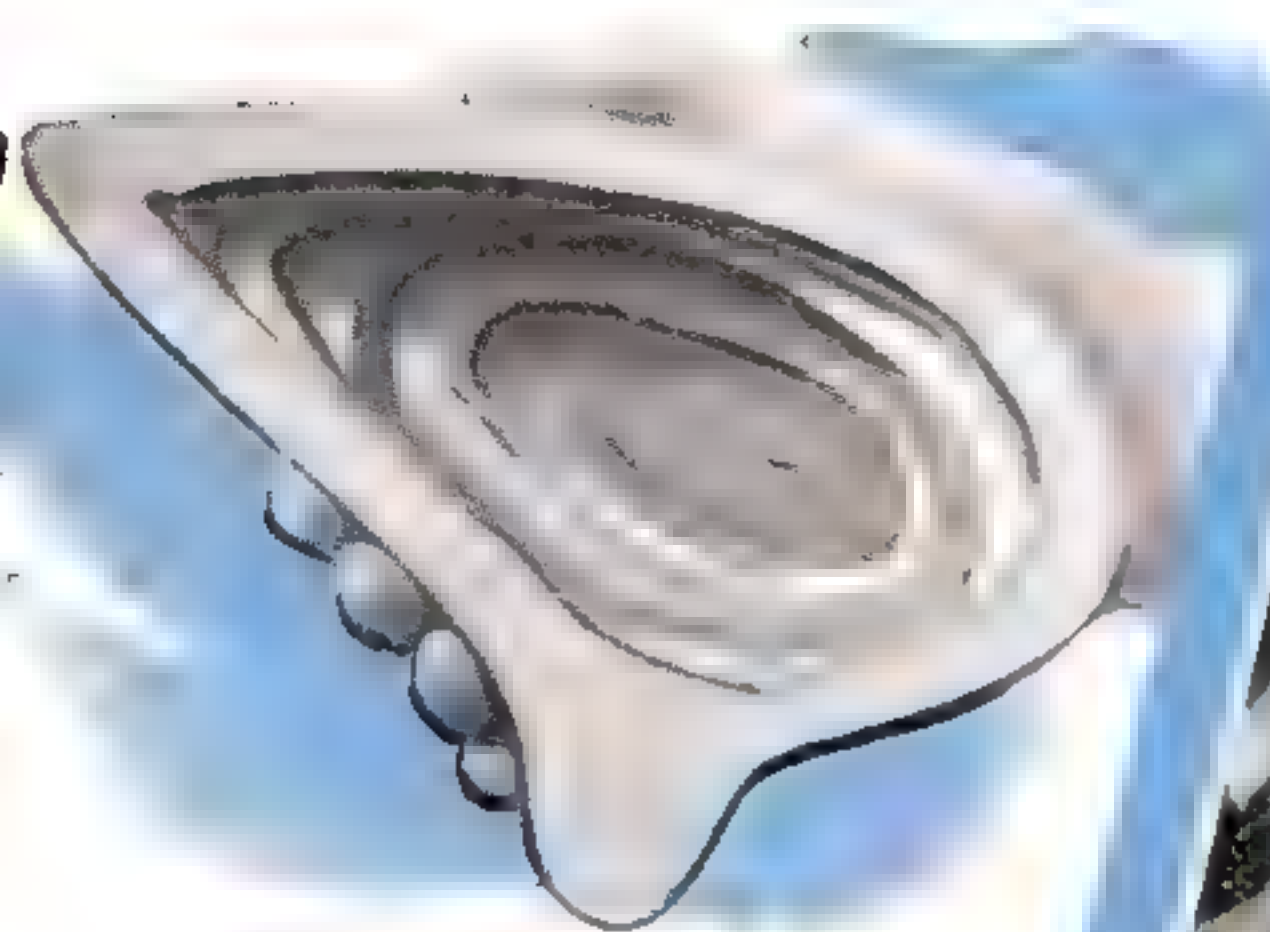


MANUFACTURING a patented product in a basement workshop after school hours, three Minneapolis, Minn., boys, Stewart Sumner, Dick Fjellman, and Oliver Engebretson, have made a flying start toward business success. Their product is a wooden variety of the ocarina, the familiar musical "sweet potato" usually made of clay. Invented by Sumner, it is made, with the help of his high-school chums, in the basement of his home. A complete layout of power and hand tools aids in the work. Each boy is in charge of a section of the "assembly line." Engebretson, for example, operates the jig saw, cutting pieces from sheets of walnut, mahogany, and maple, a quarter of an inch thick, to form the laminated body of the instrument. Waterproof glue is used to bond the laminations together. After the body of the ocarina has been shaped with garnet paper, Sumner takes over the job of tuning the instrument, producing holes of correct

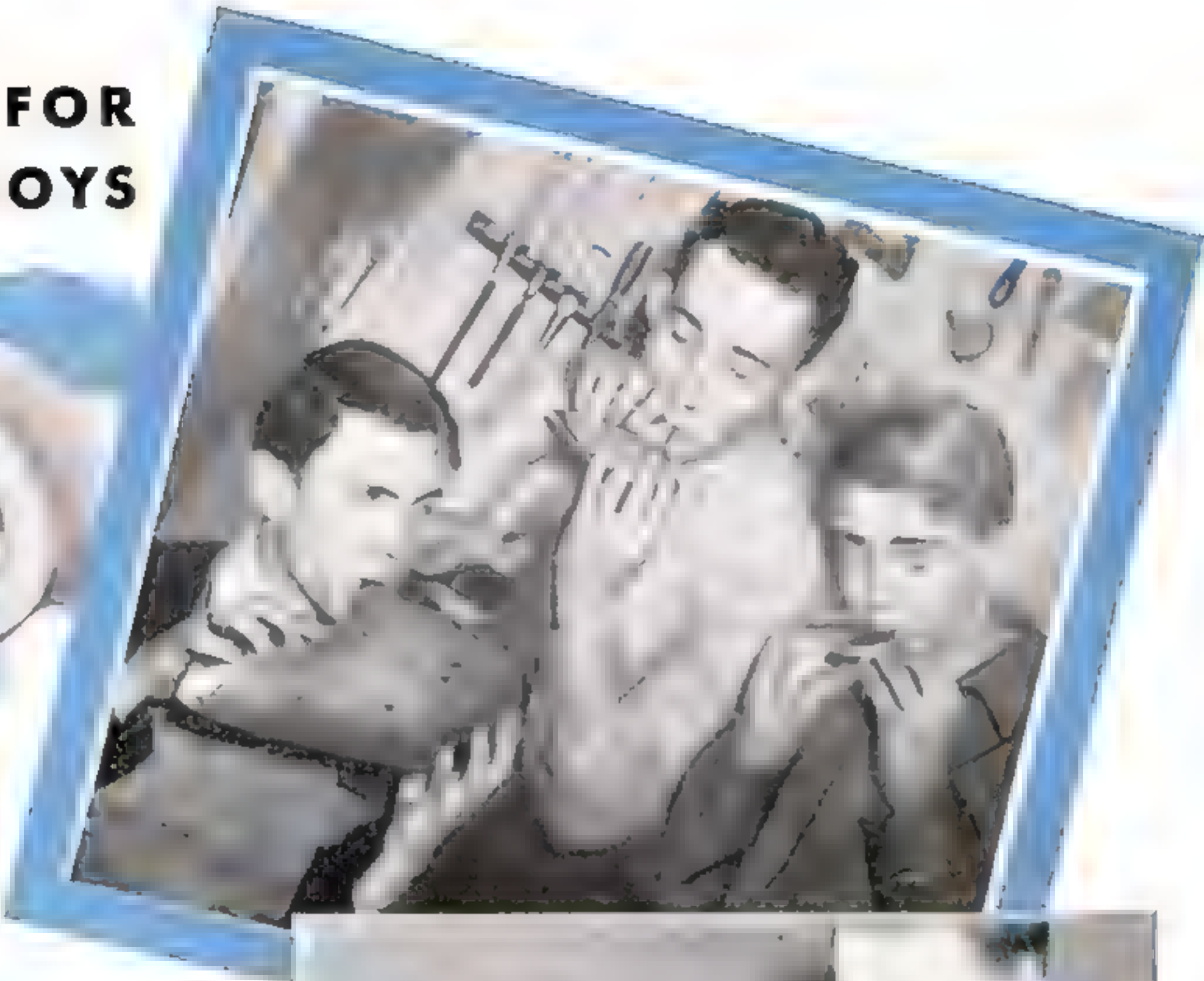


After glue has set, the instrument takes shape on a garnet-paper disk, as at left. Then Fjellman, above, starts the finger holes with a drill. Each boy has charge of a definite part of the "assembly line"

REAPS PROFIT FOR HIGH-SCHOOL BOYS



This is how the inside of a wooden ocarina looks before the two halves are glued together. Right, the boys try out some of their products



sizes with burning tools. Fjellman does the final work of polishing and finishing. The instruments are sold in several sizes, at prices as high as six dollars each. Already, more than 400 have been sold and several radio stars are using them on their programs.



To make sure that each instrument is perfect in pitch, it is tested with a tuning bar. The boys have sold ocarinas to famous radio stars



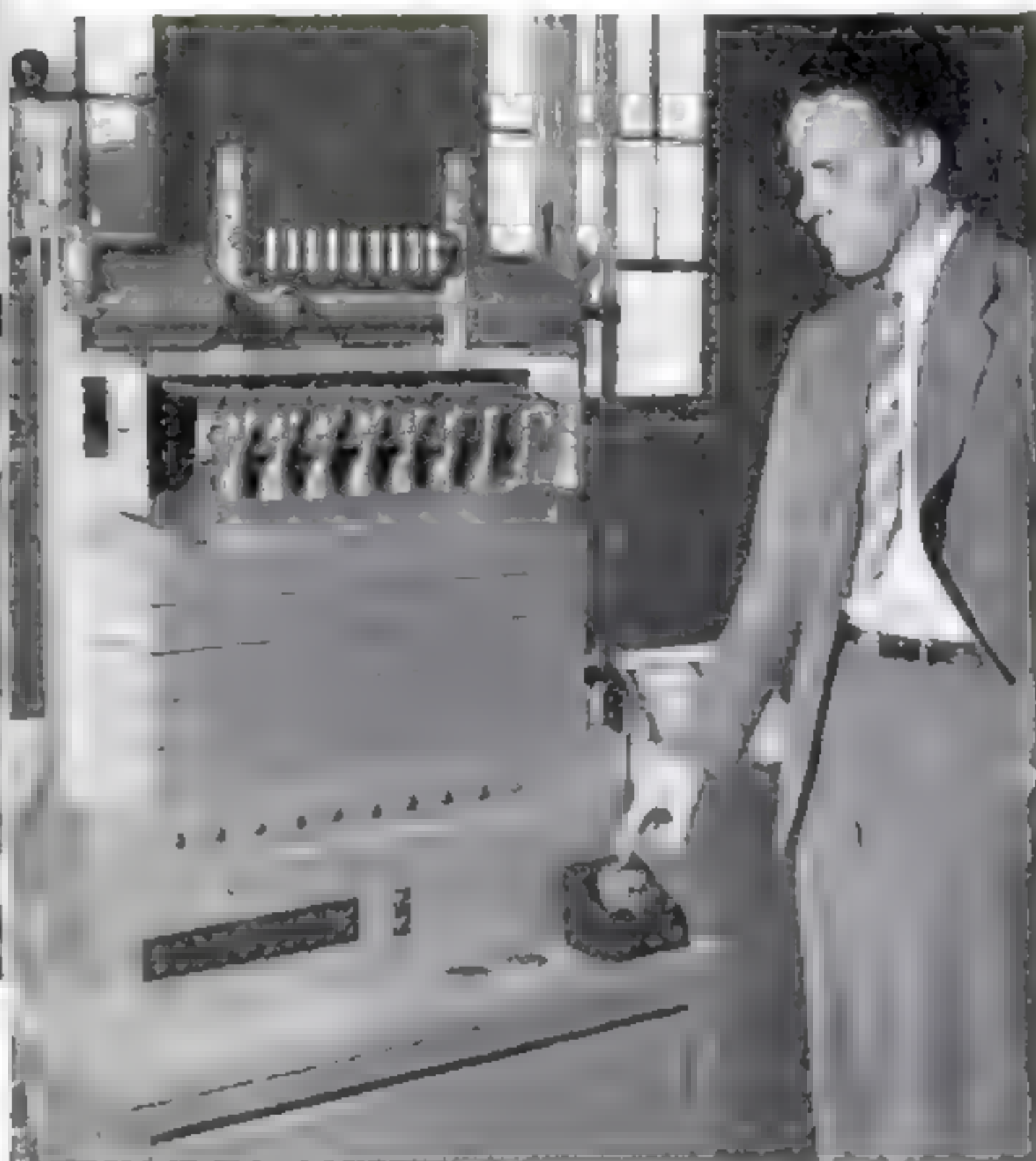
Sumner, the inventor of the wooden ocarina, does the tuning by burning out the drilled holes to the proper sizes. Right, Fjellman and Engbretson finishing instruments with sandpaper and linseed oil



Dial Connections Speed Up Telegrams



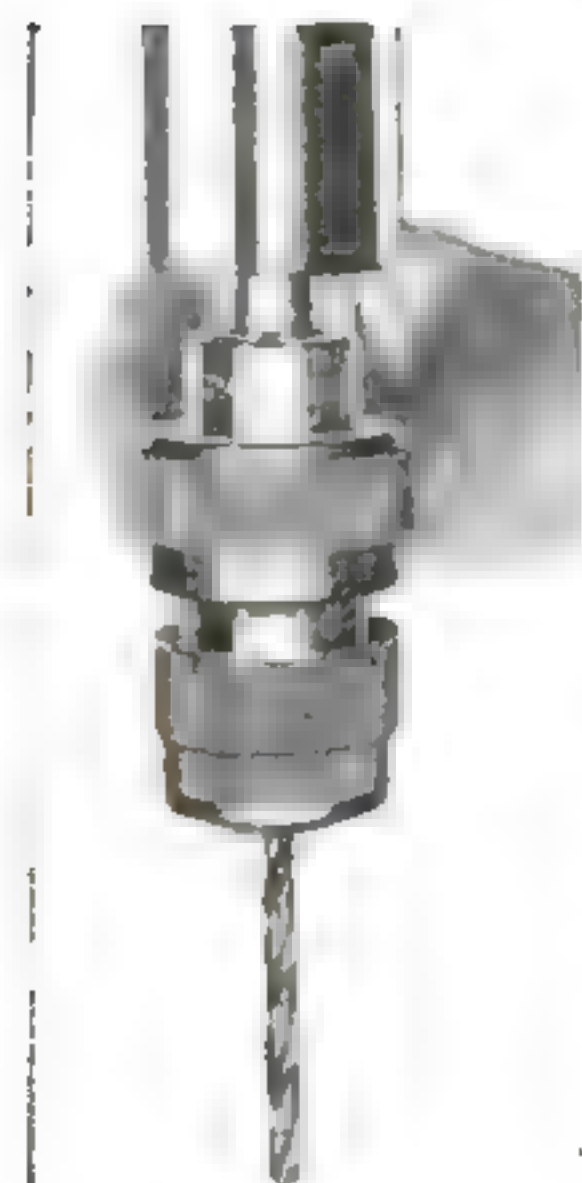
At the left, an operator is dialing a distant city before transmitting a message by teletype. Below, an engineer demonstrates the "brains" of the trunk-circuit, channel-switching system



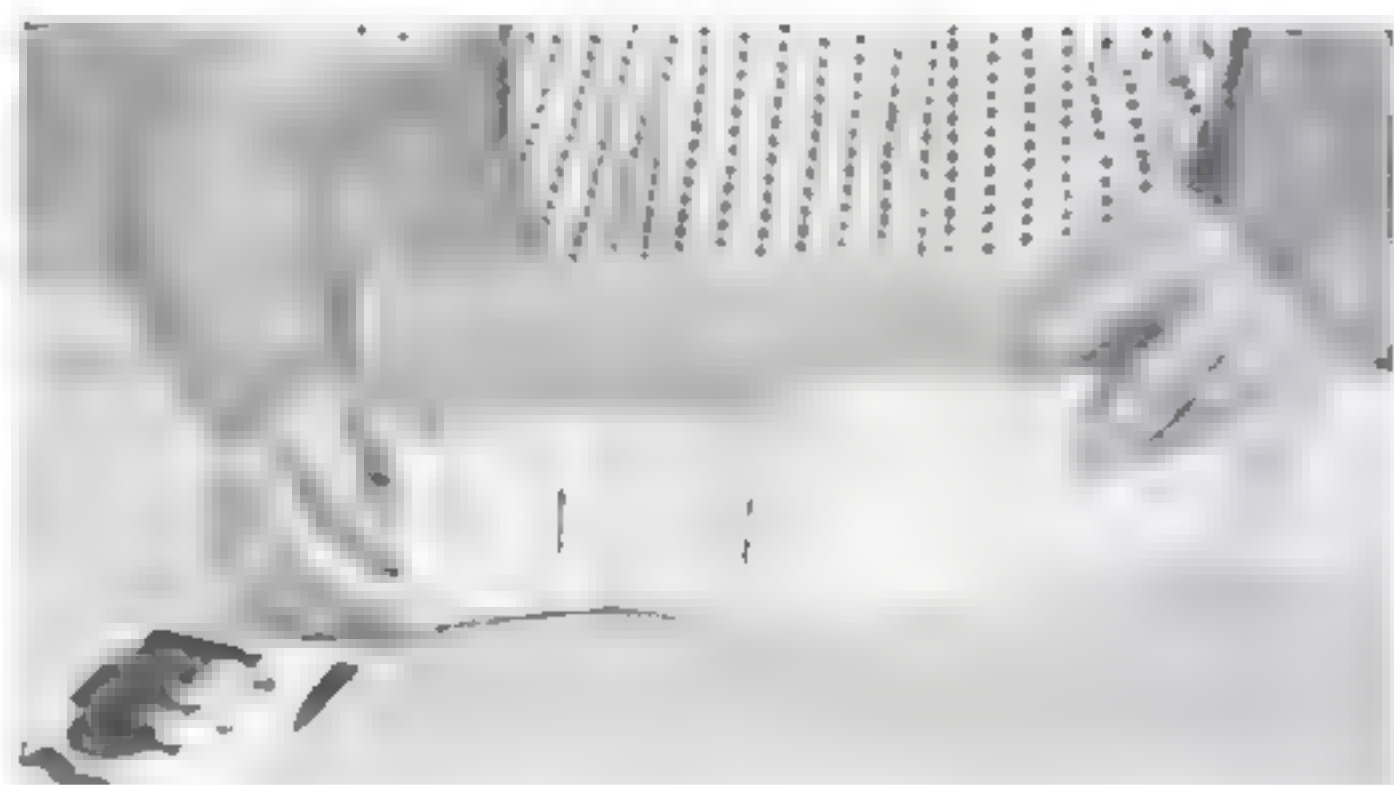
DIALS, similar to those used on metropolitan telephones, are now employed for speeding up the transmission of telegraph messages. Operators in New York City, Bridgeport, Conn., and Washington, D. C., need only to twirl a dial to connect their offices by direct circuit with the main telegraph offices at Boston, Mass., Chicago, Ill., Cleveland, Ohio, Baltimore, Md., and other leading cities. After dialing the number of the desired city, the operator then sends the message by teletype so that it ar-

rives at its destination in printed form, ready for delivery. Known as the "trunk-circuit, channel-switching" system, the new departure will increase the speed with which messages can be transmitted to distant cities. Previously, long-distance messages had to be relayed through operating centers, thus increasing the time required for transmission of telegrams.

Quick Changes Possible with New Drill Chuck



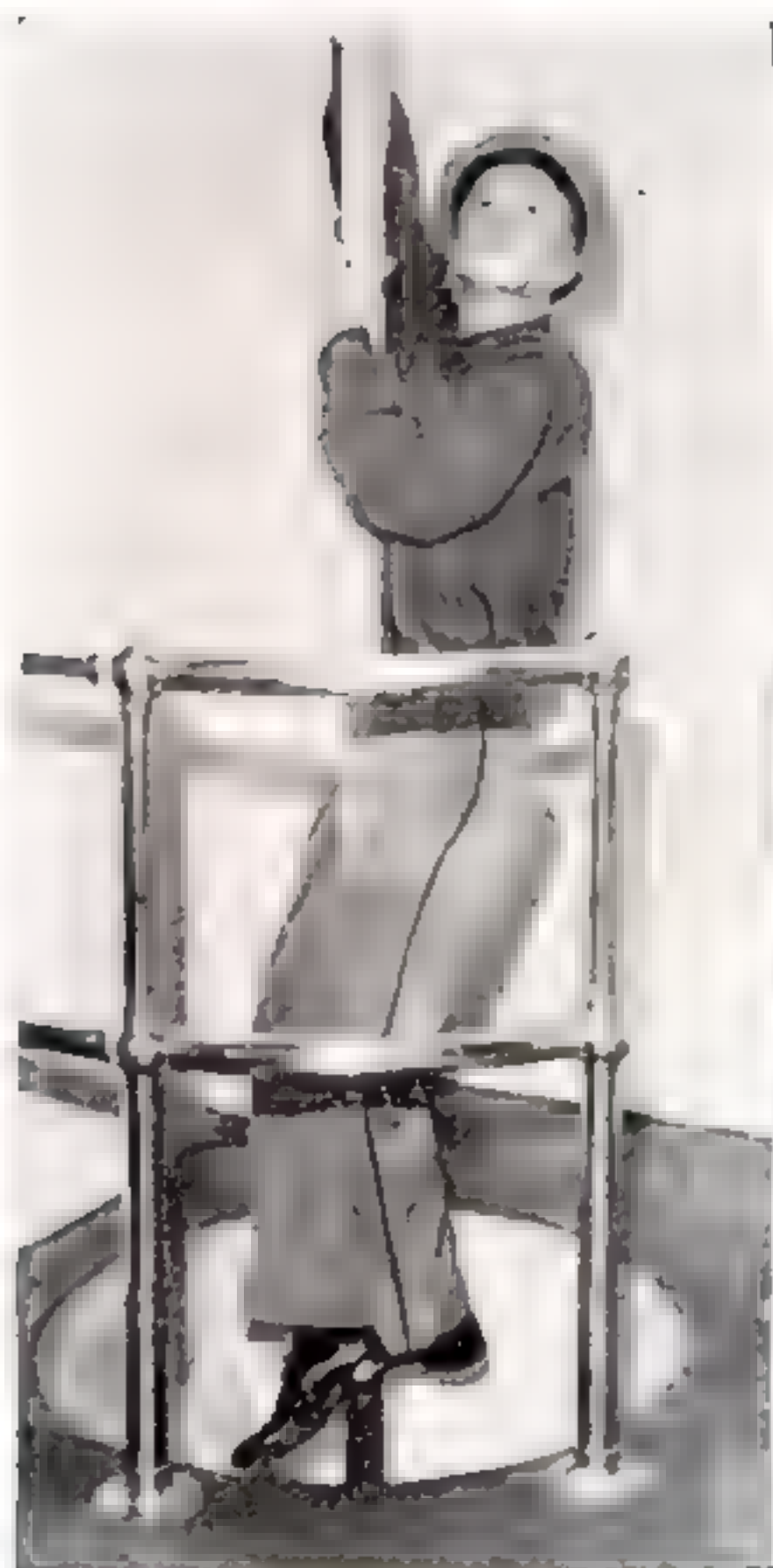
SPEEDY changing of drills is made possible by a new chuck recently introduced by a Chicago, Ill., tool manufacturer. According to the maker, the chuck permits drills to be changed safely without stopping the machine, a slight upward movement of a knurled sleeve releasing the drill. Besides the time-saving feature, the manufacturer says, the chuck reduces drill breakage.



Post Card Forms Frame for Your Own Snapshot

POST CARDS with compartments into which you can slip snapshots, are now available. Ends on the card fold back over the picture to protect it. When the card reaches its destination, these ends can be bent to turn the card into an easel frame.

Skyscraper Houses Six-Story Garage



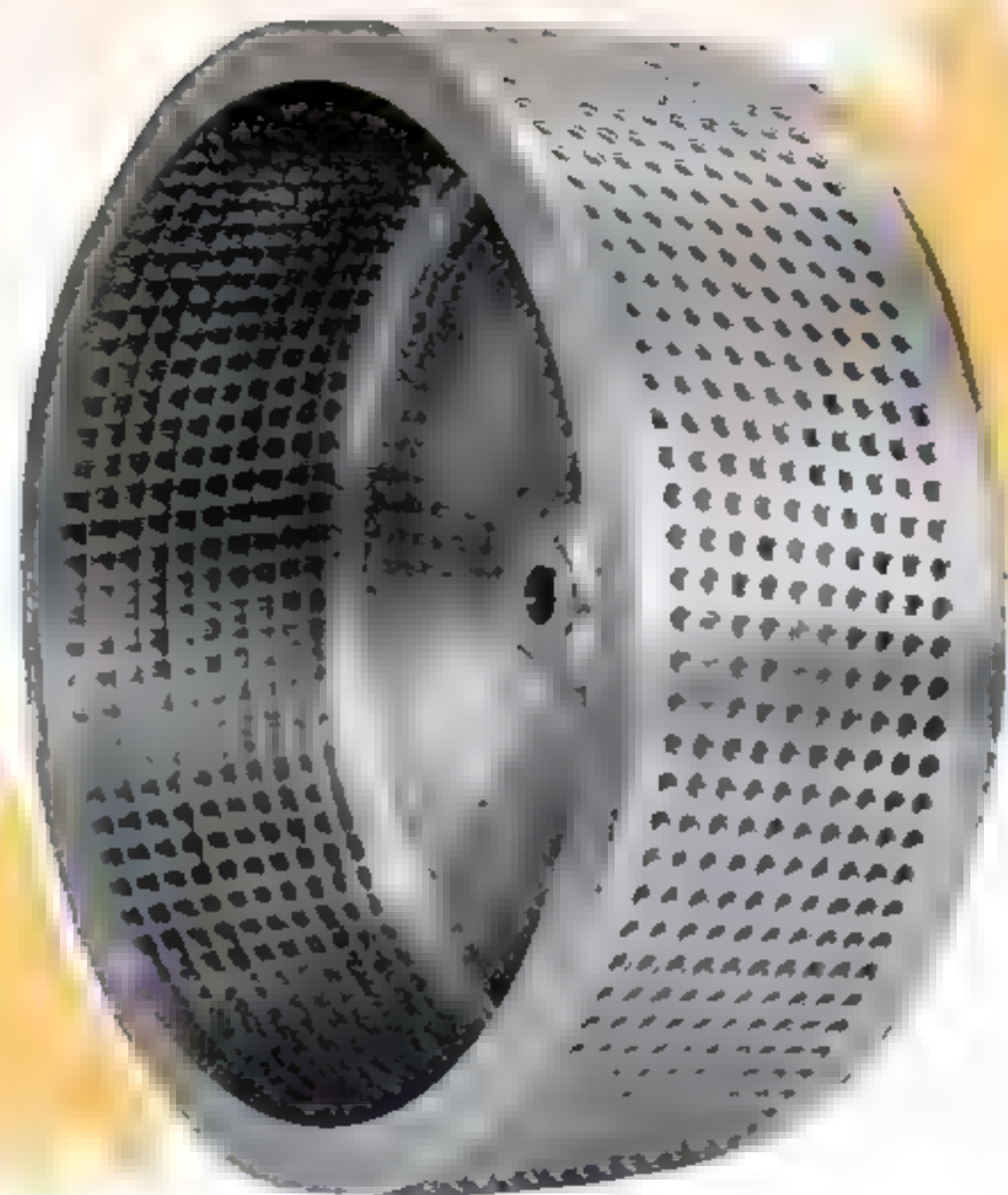
Not a fire call! Just an attendant hurrying "downstairs" for a car parked in the skyscraper's garage

EXTENDING three stories below and three stories above the street floor of a giant skyscraper, an 800-car, air-conditioned garage at Rockefeller Center effectively solves the car-parking problems for visitors to mid-town New York. Spiral ramps allow the cars to be distributed quickly to the different levels, while powerful fans continuously suck away air contaminated by the car exhausts. Broad folding entrance doors of glass

and steel, on two sides of the building, open automatically as motorists drive up to them. Regulation fire-house poles make it unnecessary for attendants to walk down stairs in parking or fetching cars.



Driving on contact plates causes the doors to open automatically. Inside, spiral ramps connect the six completely air-conditioned floors. At left, water comes mixed with soap from the laundry hoses



Electric arcs are photographed through the 1,000 openings in this drum, which revolves as fast as 7,200 times a second. Left, W. K. Rankin in front of the camera

Camera Makes 120,000 Shots in a Second

WHAT is the speediest camera in the world? According to General Electric experts, the title belongs to a new camera developed by W. K. Rankin, Philadelphia, Pa., engineer, that shoots pictures at the rate of 120,000 a second. Designed to photograph electric arcs so that their behavior can be studied in circuit breakers and other electrical apparatus, the camera is cylindrical in shape and is surrounded by a steel case large enough for a man to work in, thereby providing its own darkroom. Since it was found that conventional glass lenses caused distorting reflections of the camera's subjects, the device substitutes a revolving drum pierced with 1,000 tiny openings only one one-hundredth of an inch in diameter. Light passes through the pinholes of the drum as it is whirled 7,200 revolutions a minute during exposure of the film, which is held against the inside of the drum by centrifugal force.



Section of developed film above shows how electric arcs change in size. At right, a new film is being inserted in the cylinder. To do this, the operator gets in the camera case, which is its own darkroom



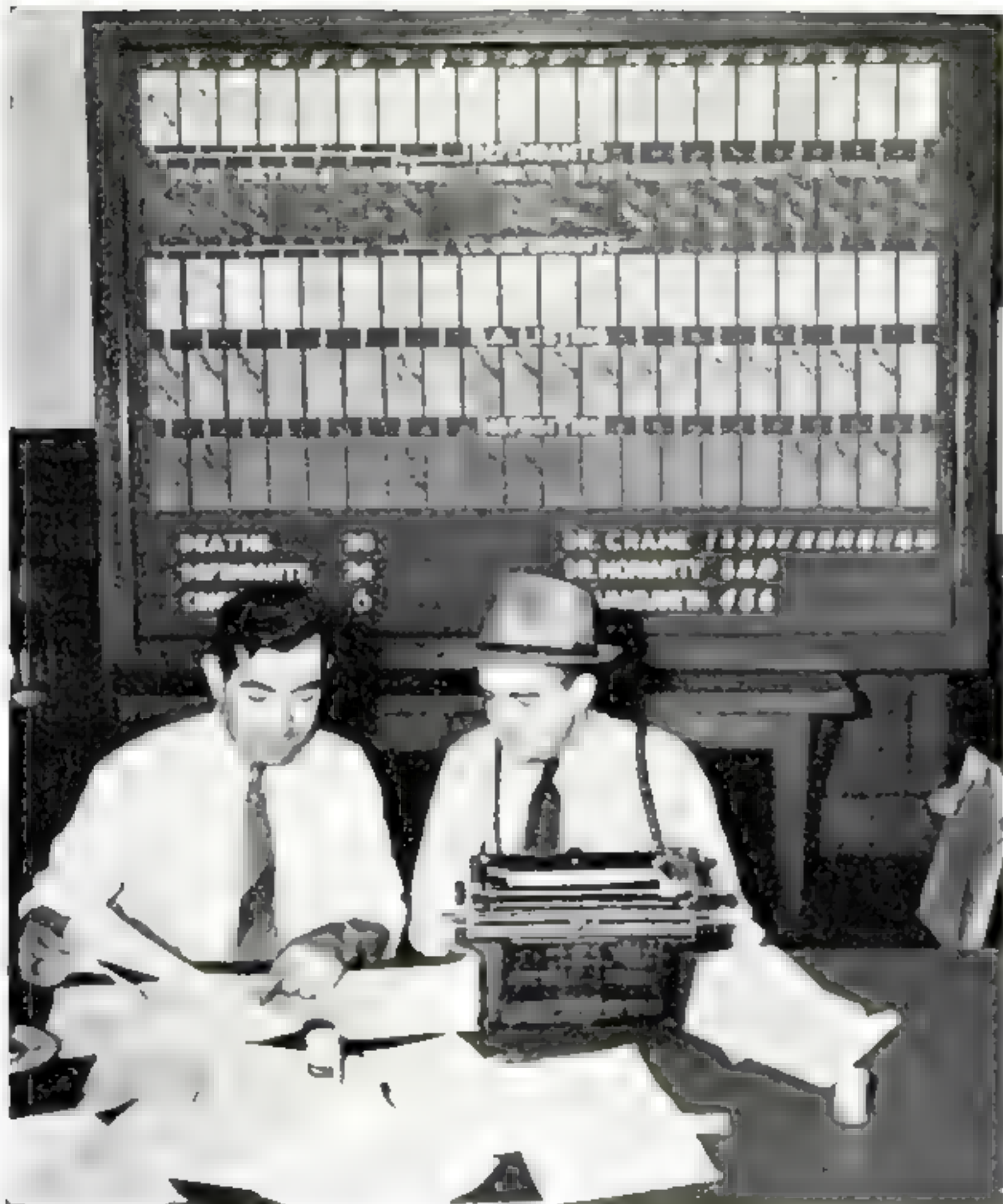


Chart Keeps Murder Record

RESEMBLING an enlarged chart of a family tree, the novel panel shown in the background, above, has been helping Philadelphia detectives and prosecutors keep track of a sensational series of murder trials. The first line lists twenty victims allegedly poisoned for profit by an "arsenic ring." Names of defendants and codefendants appear beneath.

Funnel Fits Upright on End of Barrel

THERE'S no need to up-end heavy barrels, when a new type of funnel is used to replenish their contents. With its spout inserted in the bunghole, the funnel stands securely in place. Built-in brackets rest against the end of the barrel to support it, as shown in the illustration below. The wide mouth of the funnel avoids any likelihood of spilling the liquid.



Brackets support the funnel so that the barrel need not be up-ended for filling

Beautifies "Bingo" Beans as Business

BY PAINTING Lima beans in fancy colors, Stanley Nowicki, of Grand Rapids, Mich., has found a new and profitable occupation. His customers are establishments that conduct games of "Beano," a pastime resembling "Bingo" or lotto, in which the dried beans are used as markers on numbered cards. They were uncolored until Nowicki introduced the idea of tinting them to make them more attractive. His raw material for each batch is a 100-pound sack of beans of the large California variety. These he divides into as many piles as there are colors to be used. Each pile gets a coat of the desired shade, applied with a quick-drying material that leaves a high gloss.



Stanley Nowicki at work coloring beans used in "Bingo" games

How Well Do You Get

CHECK YOUR PERSONALITY

HOW WELL ARE YOU ADJUSTED TO YOURSELF?

- 1 Is it easy for you to introduce or be introduced to people? Yes ☐ No ☐
- 2 Do you find it hard to keep from being bossed by people? Yes ☐ No ☐
- 3 Do you usually get upset when things go wrong? Yes ☐ No ☐
- 4 Do people seem to think you are dependable? Yes ☐ No ☐
- 5 Do members of the opposite sex seem to like you? Yes ☐ No ☐
- 6 Are you considered a failure in many of the things you do? Yes ☐ No ☐
- 7 Do you have to do what other people tell you to do most of the time? Yes ☐ No ☐
- 8 Do you feel that you are given enough liberty in doing what you want to do? Yes ☐ No ☐
- 9 Do the people at home make you feel that you are an important part of the family? Yes ☐ No ☐
- 10 Have you found it difficult to make as many friends as you wish? Yes ☐ No ☐
- 11 Do you feel that you fit well into the community in which you live? Yes ☐ No ☐
- 12 Do you find many people inclined to say and do things that hurt your feelings? Yes ☐ No ☐
- 13 Do you often feel that people do not appreciate you or treat you as they should? Yes ☐ No ☐
- 14 Are you more restless than most people? Yes ☐ No ☐
- 15 Do you frequently find that you read several sentences without realizing what they are about? Yes ☐ No ☐



RECENTLY, three California educators announced the perfection of a scientific test which analyzes your personality and ability to get along with the world just as the familiar intelligence test reveals the quality of your mind.

Three years of research and experiment went into their psychological questionnaire. The scientists, Drs. Ernest W. Tiegs and Louis P. Thorpe, of the University of Southern California, and Willis W. Clark, Director of Administrative Research for Los Angeles County schools, worked out an original list of 1,000 questions. Combining them in various ways, they tried them out on 800 high-school and junior-college students in and around Los Angeles.

Along with People?

WITH THIS NOVEL TEST

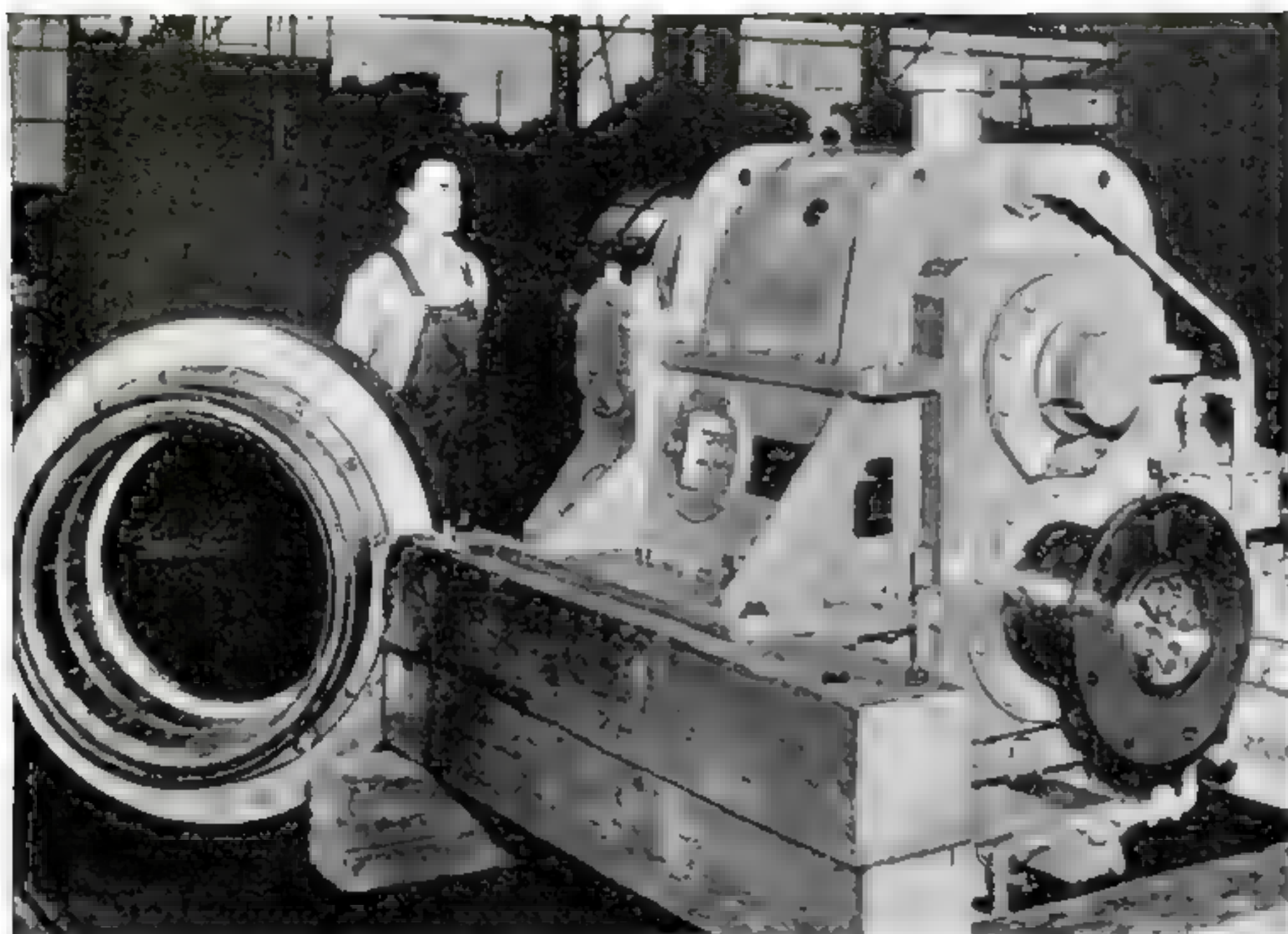


By means of such "previews," the educators were able to eliminate queries which were too obvious or for other reasons unsatisfactory. In the end they reduced their list to 180 questions. In this form, it has become known to psychology as "The California Test of Personality."

The thirty searching queries which appear on these pages were selected by the scientists as a condensed test. By answering the queries honestly, you can make a scientific self-analysis of your character and your ability to get along in the world in which you live. The questions at the left reveal your self-adjustment; those at the right your ability to get along with others. When you have answered all, turn to page 238.

HOW WELL ARE YOU ADJUSTED TO OTHER PEOPLE?

- 1 If you need something badly enough and cannot buy it, are there times when it is all right to take it? Yes ☐ No ☐
- 2 Should a person be courteous to disagreeable people? Yes ☐ No ☐
- 3 Is it necessary to obey "No Trespassing" signs? Yes ☐ No ☐
- 4 Is it easy for you to talk with people as soon as you meet them? Yes ☐ No ☐
- 5 Do you frequently find it necessary to interrupt a conversation? Yes ☐ No ☐
- 6 Do you have many friends rather than just a few? Yes ☐ No ☐
- 7 Do you have to talk about yourself and your abilities in order to get recognition? Yes ☐ No ☐
- 8 Do you often have to fight or quarrel in order to get your rights? Yes ☐ No ☐
- 9 Do the members of your family frequently have good times together? Yes ☐ No ☐
- 10 Does some one at your home quarrel with you too much of the time? Yes ☐ No ☐
- 11 Do you avoid inviting others to your home because it is not as nice as theirs? Yes ☐ No ☐
- 12 Do you like to take care of your own or some neighbor's pets? Yes ☐ No ☐
- 13 Does it make you happy to know that your neighbors are getting along well? Yes ☐ No ☐
- 14 Are there people of certain races that one should not be expected to tolerate? Yes ☐ No ☐
- 15 Are many of your neighbors the kind of people you dislike? Yes ☐ No ☐

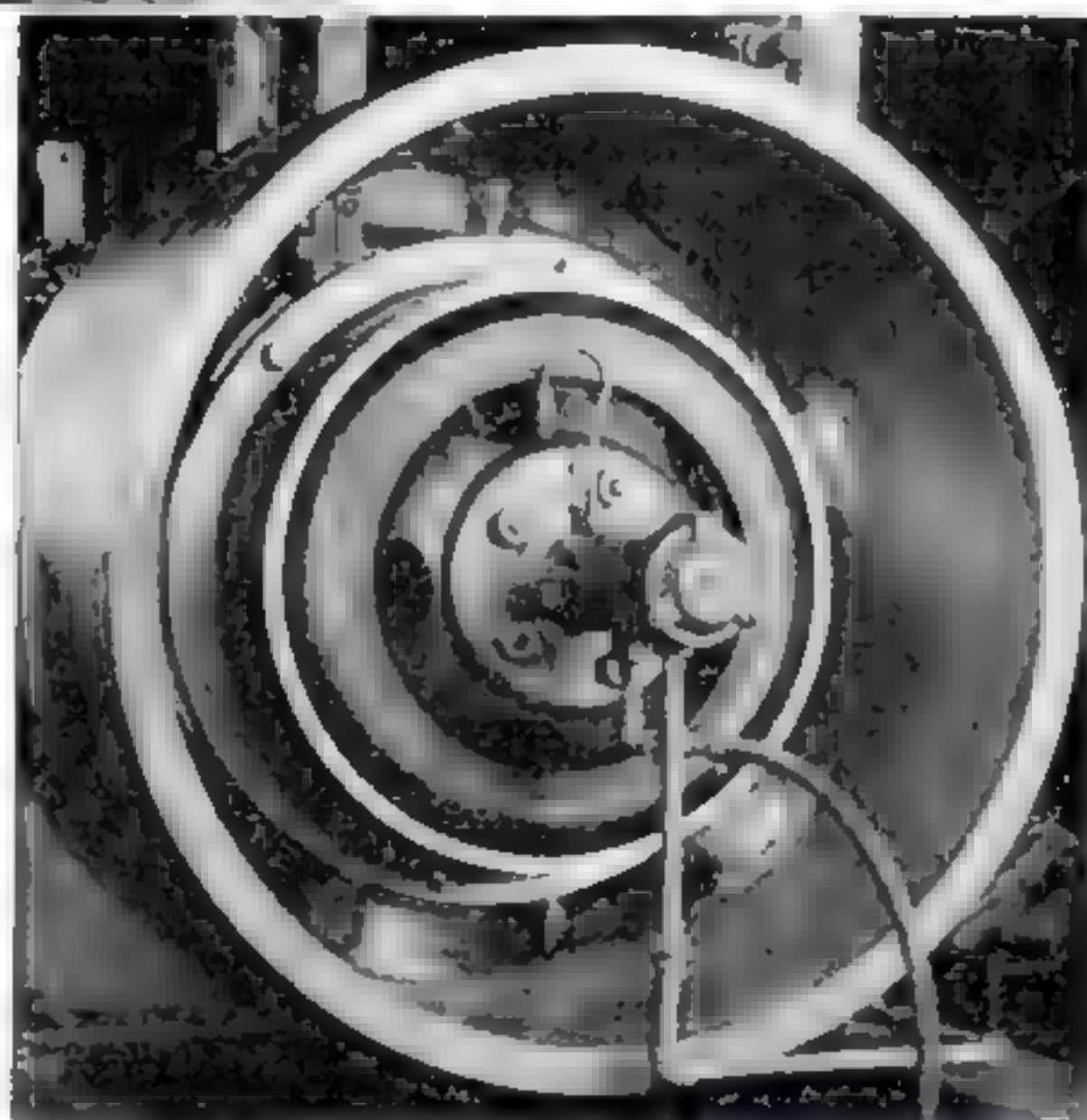


A heavy gear housing equipped with the new clutch. At the right, above, note the tirelike tread and construction



New Tirelike Clutch Works by Inflation

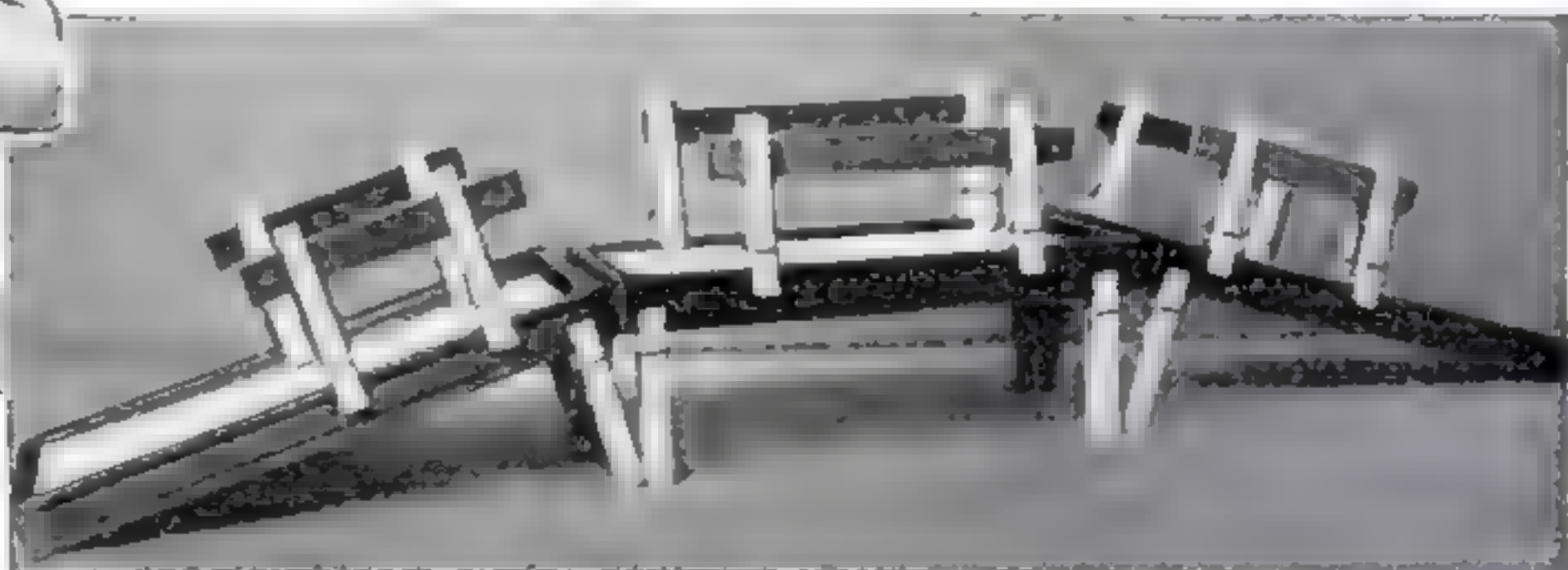
RESEARCH at an Akron, Ohio, tire factory has resulted in the perfection of a radically new rubber clutch for Diesel and marine engines. Tire-like in shape and construction, the new clutch is operated by air pressure instead of the usual levers and springs. Air forced into the clutch inflates the rubber doughnut and causes it to make perfect contact with the inside of a metal cylinder which serves as the clutch plate. In recent tests, a towboat fitted with the new unit was changed rapidly from full speed ahead to full astern 1,400 times, with no appreciable wear.



External details of the clutch are shown here. The air line that inflates the rubber casing enters at the central shaft

Clothespin Toymakers Come in Kit

COLORFUL clothespins, providing the ingenious youngster with material for making a wide variety of toys, are now being sold in compact kits, containing either sixty-five or 100 spring-type pins. The larger set also contains pulleys and wheels. Instructions are given for producing toy bridges, windmills, and other structures. No tools are required as the pins remain clamped in place.



Dozens of toys like this can be made with the novel clothespin set

Canned, Frozen Sunlight Shipped by Airplane

CANNED sunshine, absorbed by luminescent powder and flown from Florida with the powder frozen by liquid air to a temperature of 300 degrees below zero F., recently turned on lights in New York City. As the tube thawed out, the powder began to glow, releasing solar energy. Through a photo-electric cell, this light turned on the electric current. Samuel G. Hibben, Westinghouse lighting expert, conducted the demonstration.

Shells Serve as Models for Fast War Planes

PHOTOGRAPHING field-artillery shells in flight is a plan to be used by British aeronautical experts in designing faster fighting and bombing planes. The pictures, made by fixed-focus cameras on artillery proving grounds, are expected to reveal stresses built up by air resistance around plane noses of various shapes, better than tests made with stationary models in wind tunnels.



This tube contains "bottled sunlight" from Florida

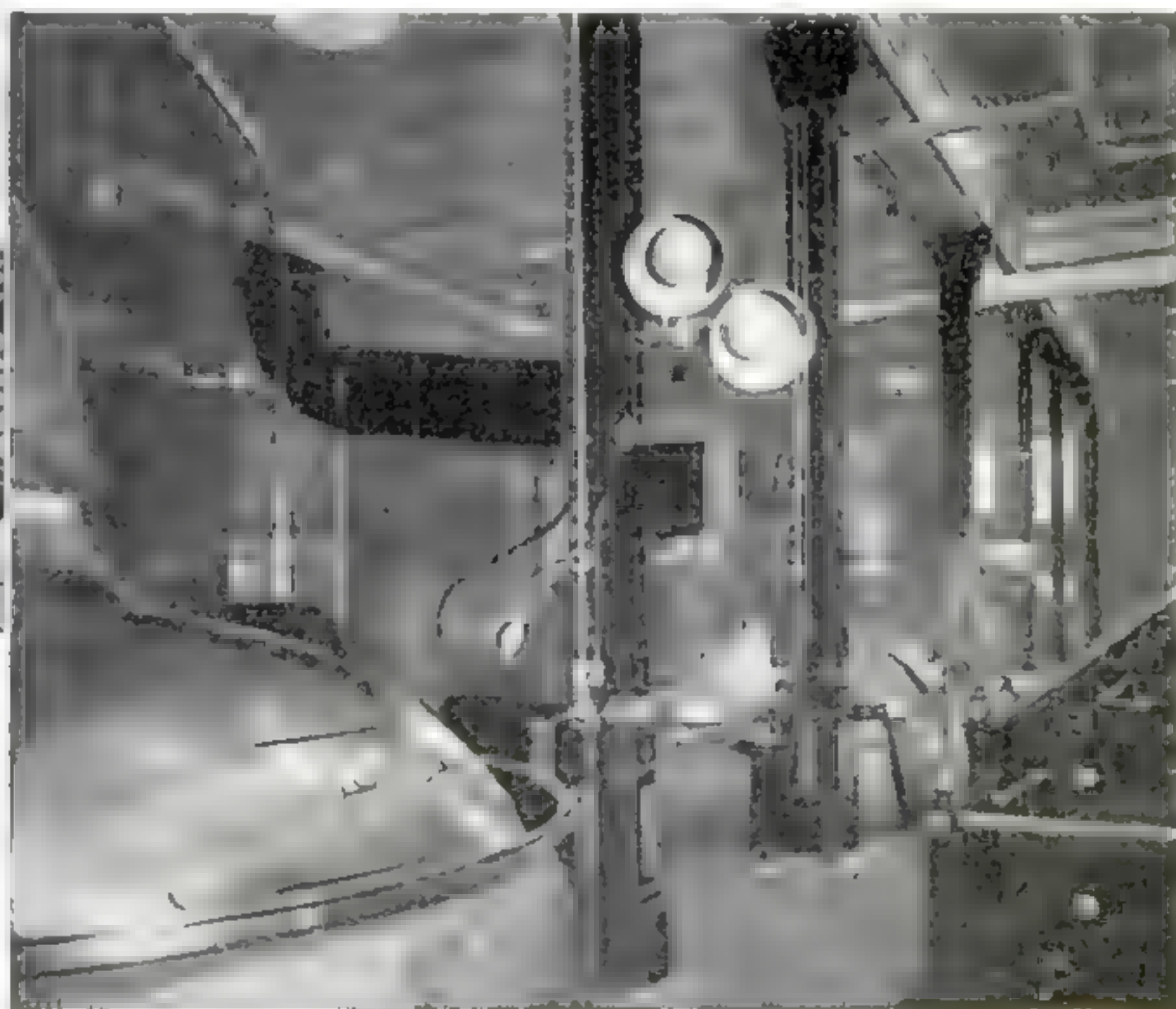


Loudspeakers set into the wall of a Milwaukee brewery invite passers-by to come in and inspect the plant

More amplifiers inside, as at the right, sound off with a recorded talk when a guide presses a button

Phonograph and Loudspeakers Explain Brewery to Visitors

WHEN a Milwaukee, Wis., brewing company found 5,000 persons a week were visiting its plant, it replaced lectures by regular guides, who had difficulty making themselves heard above the noise of the machines, with talks reproduced by phonograph records and amplifiers. Now, the various steps in brewing are explained to visitors by loudspeakers scattered about the plant.



Gas Turbines Promise

HOW SEARING FLAMES ARE HARNESSSED

FIRST of its kind in the world, a "pocket powerhouse" of sensational new design will soon be ready for emergency service in a bombproof tunnel at Neuchâtel, Switzerland. Its machinery, already completed and tested successfully, includes neither towering steam boilers nor other bulky accessories. Hence the whole installation fits easily into a concrete chamber only sixty feet long, seventeen feet wide, and twenty-seven feet high. Yet it will generate enough electricity to supply the whole city of 23,000 inhabitants with light and power, at a few minutes' notice, in case the existing municipal power station should be put out of commission.

This mighty midget among electric plants concerns not only the people of Neuchâtel, but the whole world as well. The remarkable machine that drives its 5,300-horsepower generator looks and works like a steam turbine—but steam is not what propels its whirling blades. Instead, it is a searing blast of gas from a roaring jet of ignited oil, hurled against the rotor at a temperature of 1,000 degrees.

Here is the realization of many an inventor's dream — a practical high-pow-

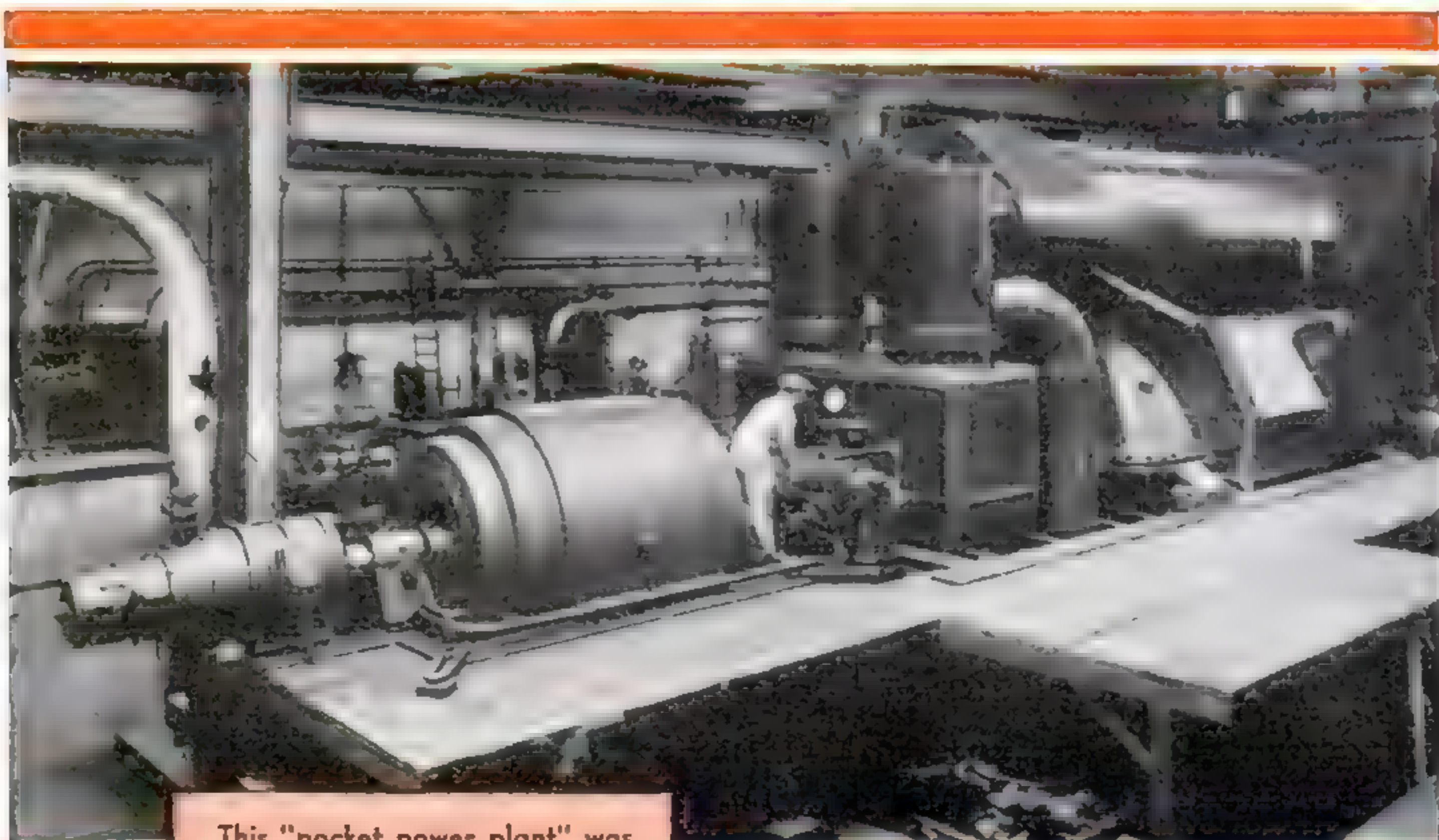
ered gas turbine. Forward-looking engineers have long seen it coming. Now it takes its place, as a brand-new kind of prime mover, beside the steam engine and steam turbine, the gasoline motor, and the Diesel.

Because of their compact size, gas turbines may well propel the narrow-hulled destroyers of the world's navies, and other speedy craft. On land, they may drive locomotives that haul crack flyers. Besides generating electricity in power stations, gas turbines may be expected to displace other forms of power in certain industries, for which they are peculiarly well adapted. And these are only a few of the applications that coming years may find for them, according to the originators of the new design, the Brown Boveri firm of Baden, Switzerland, one of the world's leading makers of power machinery.

How a gas turbine works is illustrated in an accompanying drawing, where it is shown in use for generating electricity. It has three vital parts: a blower of special design, a combustion chamber, and the turbine proper. From the blower, compressed air under a pressure of thirty to fifty pounds

to the square inch enters the combustion

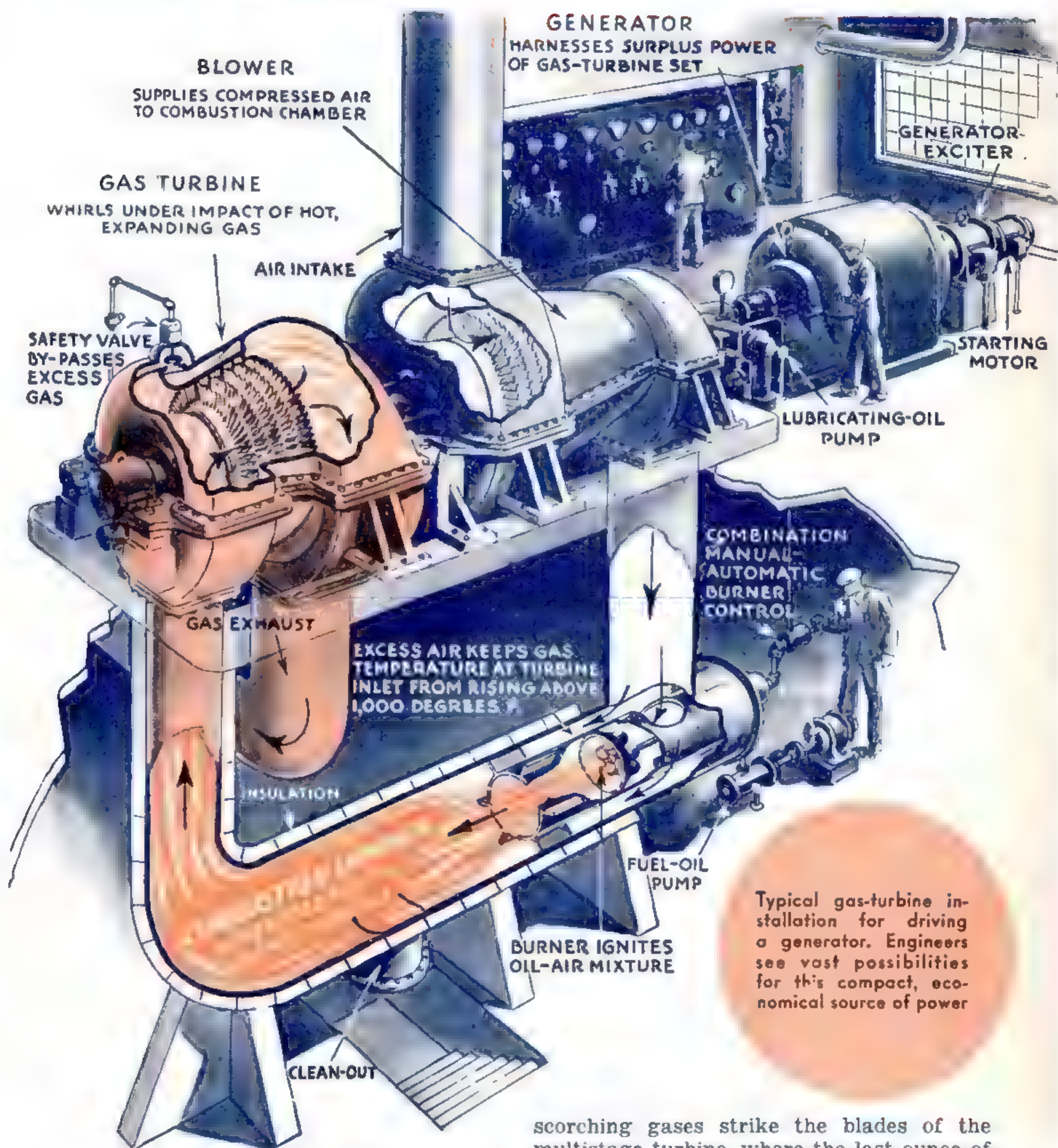
By **ALDEN P. ARMAGNAC**



This "pocket power plant" was designed for a bombproof emergency generating unit

New Era in Power

TO TURN WHEELS



Typical gas-turbine installation for driving a generator. Engineers see vast possibilities for this compact, economical source of power

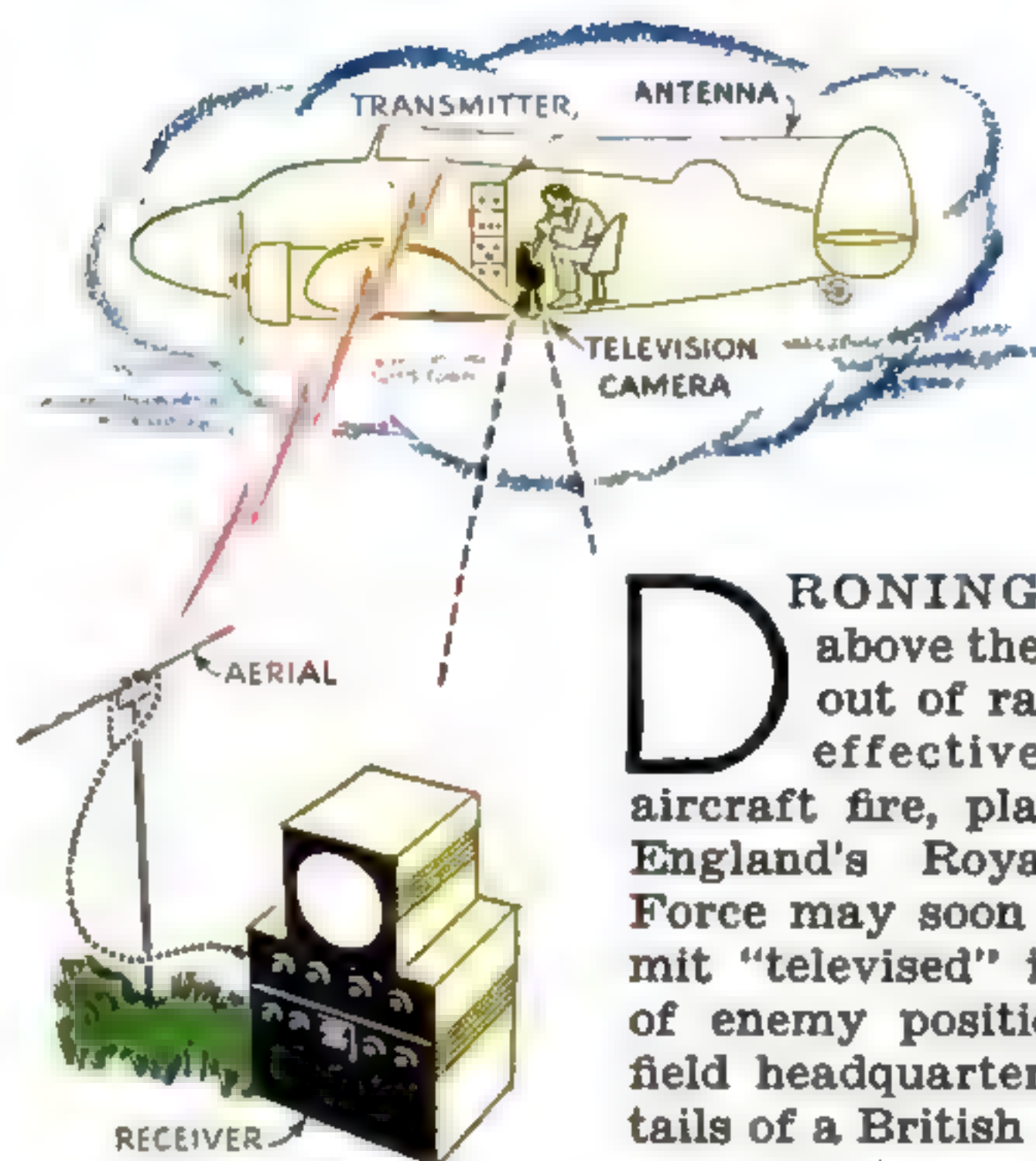
chamber, transforming the flaming spray of an oil burner into a seething inferno. Expanding vapors rush onward toward the gas turbine as they burn. Air from a secondary inlet brings them down to 1,000 degrees Fahrenheit—considered, at present, the upper safety limit of temperature. Now the

scorching gases strike the blades of the multistage turbine, where the last ounce of energy is extracted from them before they escape through an exhaust port to the stack.

Mounted on the same shaft as the turbine, the blower whirls with it, about three fourths of the turbine's power going to operate the blower. The rest is useful power for driving the (Continued on page 236)

TELEVISION PLANES

SPY ON ENEMY LINES



DRONING high above the earth, out of range of effective anti-aircraft fire, planes of England's Royal Air Force may soon transmit "televised" images of enemy positions to field headquarters. Details of a British patent issued to the country's leading television firm,

just before the outbreak of hostilities, reveal how territory over which a plane is flying will automatically be scanned to secure information of strategic value.

Mounted over a window in the bottom of the fuselage, an aerial television camera with telescopic lenses operates continuously while the plane is in flight. As the craft soars past trenches, gun emplacements, military roads, and ammunition dumps, the television "eye" translates high lights and shadows into a string of electrical impulses, and a compact but powerful radio puts them on the air.

Back at headquarters, the commanding officer sits at the screen of his television receiver, intently watching the same panorama unroll. With the disclosure of each important objective, aides insert pins in a military map to show where artillery fire should be concentrated or bombing planes dispatched.

Over reconnaissance by aerial photography, the new television system presents certain marked tactical advantages. No precious minutes or hours are lost while the plane returns to its base, or while films are developed, during which time the battle scene may have undergone important changes. Instead, shifts in the

disposition of fast motorized columns, and other events in the speeded-up tempo of modern warfare, are revealed at the very moment they take place.

In addition, the television "eye" will see through camouflage that effectively masks ground activities of the enemy in ordinary aerial photos. Wearing sprigs of foliage in their headgear, advancing or retreating soldiers may be indistinguishable from the surroundings in still pictures—but the telltale screen of the television receiver clearly reveals any moving object, making concealment doubly difficult. Any scenes of special interest can be photographed on the receiver screen.



LOOKING BEYOND THE LINES

Officers at field headquarters look down on hostile positions and troop movements in television images radioed from a plane

NEW SYSTEM OF MILITARY RECONNAISSANCE PRESENTS COMMANDERS WITH AN ACTUAL PICTURE OF CONDITIONS



WAR IN THE AIR



Division of nine U. S. Army planes flying in formation. This flight pattern, which is called "echelon of echelons," is one of the many complicated groupings used in modern sky fighting by massed planes

WITH aerial armadas battling in European skies, one of the most dramatic developments of the war has been the rise of the massed air attack. The picturesque ace of yesterday is largely a thing of the past. Single-handed battles aloft have been replaced by the clash of massed engines of destruction, compact, highly-trained groups which act as units.

War birds who handle the controls in such close-formation flights, are trained like gridiron stars. Basic maneuvers, like the plays of a football team, are practiced hundreds and thousands of times. Groundwork, comparable to the "skull practice" of college players, forms part of the day's activity for the airmen. And, day after day, during the training period, they engage in "signal practice" in the sky, the ships maneuvering and shifting places at the leader's command. As a result, when fighting ships head out over enemy lines for a mass attack, every

pilot is letter-perfect in the part he is to play.

In step with this new development, flyers of the U. S. Army and Navy are receiving intensive training in formation flying. An innovation in the work has just been introduced at the Navy air base at Floyd Bennett Field. This is the use of model airplanes to supplement drawings and sketches.

Squatting in a circle around Lieutenant-Commander D. F. Smith, the officer who originated the new departure in teaching, the pilots watch him shift the model planes about to form V's and angles and straight lines, each representing a basic formation for wartime flying. As each shift in position occurs, Commander Smith explains to the individual pilots the correct handling of their machines. Thus the war flyers are able to visualize the maneuvers as a whole, as well as to see the path their particular ships should follow.



HOW MODERN FLYERS FIGHT AIR BATTLES AS TEAMWORK REPLACES SINGLE COMBAT

As mass fighting has increased in complexity, larger and larger formations have become a feature of war flying. The original, and smallest, unit in formation sky fighting is the "section." It consists of three planes. When two or three sections are operating as a unit, they are known as a "division." The air "squadron" contains two or more divisions. A "wing" is formed of two or more squadrons, while the largest present-day unit is the "group." It consists of four squadrons, flying under an air-group commander, and contains at least ninety-six fighting planes. Both naval and land pilots follow essentially the same technique in formation flying.

At Floyd Bennett Field, during his instruction with model ships, Commander Smith uses six miniature machines, representing two sections. Over and over again, he moves them into a half-dozen basic formations. Later, when the Navy airmen

take off for aerial signal practice, they guide their full-size ships in the same maneuvers.

The original formation position, the "section V," is taught first. The leader, or No. 1 plane, forms the point of the V with the two "wing men" flying behind and to either side. The trailing plane at the left of the leader is known as No. 2; that at the right, No. 3. When two such V's are flying side by side, the formation is called a "line of sections." If one of the V's drops back to a position behind, above, and to one side of the other, the formation is known to war birds as an "echelon of section V's."

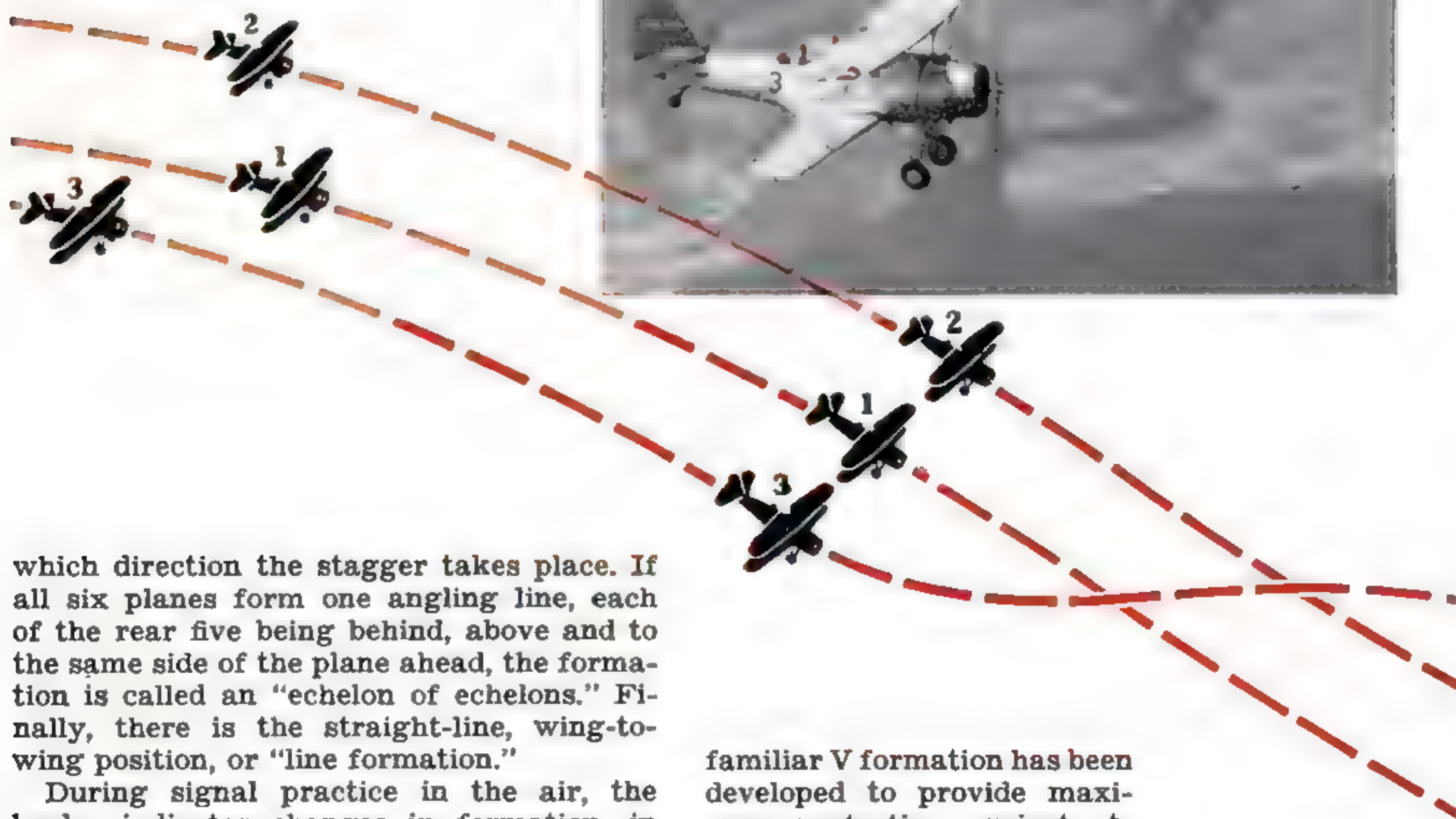
The term for a formation in which the six planes of the division assume the position of two stairways slanting in opposite directions away from a central line is "opposite echelons." If the two "stairways" are parallel, the formation is called a "left echelon" or a "right echelon," according to



"Skull practice" on the ground: Lieutenant-Commander D. F. Smith demonstrating a bombing formation at Floyd Bennett Field air base



Three Navy planes flying in the elementary "section V" formation. At a signal from the leader, in circle, the trailing planes pull up abreast for "line formation"



which direction the stagger takes place. If all six planes form one angling line, each of the rear five being behind, above and to the same side of the plane ahead, the formation is called an "echelon of echelons." Finally, there is the straight-line, wing-to-wing position, or "line formation."

During signal practice in the air, the leader indicates changes in formation, in many instances, by holding out his arm. Straight out, parallel with the wings, it signals a line formation. Held vertically overhead, it means the echelon formation. Held down outside the cockpit, it indicates a return to the familiar V formation. Radio, in addition to manual signals, also plays an important part in directing large groups of planes in wartime attack and defense maneuvers.

For bombing flights, a variation of the

familiar V formation has been developed to provide maximum protection against attackers. Five big machines form a V while the sixth flies between the two last planes and in line with the leader. Such a formation, in the first place, enables the machines to drop a salvo of bombs on a concentrated area and thus inflict a maximum of damage. Again, the huge and relatively slow machines have little chance to outmaneuver the sky hornets of enemy pursuit squadrons. Their greatest chance of safety in the event of an

attack is to fly in a compact group so they can bring a concentrated blast of gunfire on the attacking planes.

Naval pilots, particularly in sea work, find added safety in numbers. The fact that the smallest unit contains three machines is a factor in rescuing pilots out of sight of land. If one of the three planes is forced down, one of the remaining ones can stand by while the third races to the nearest ship or land base for help.

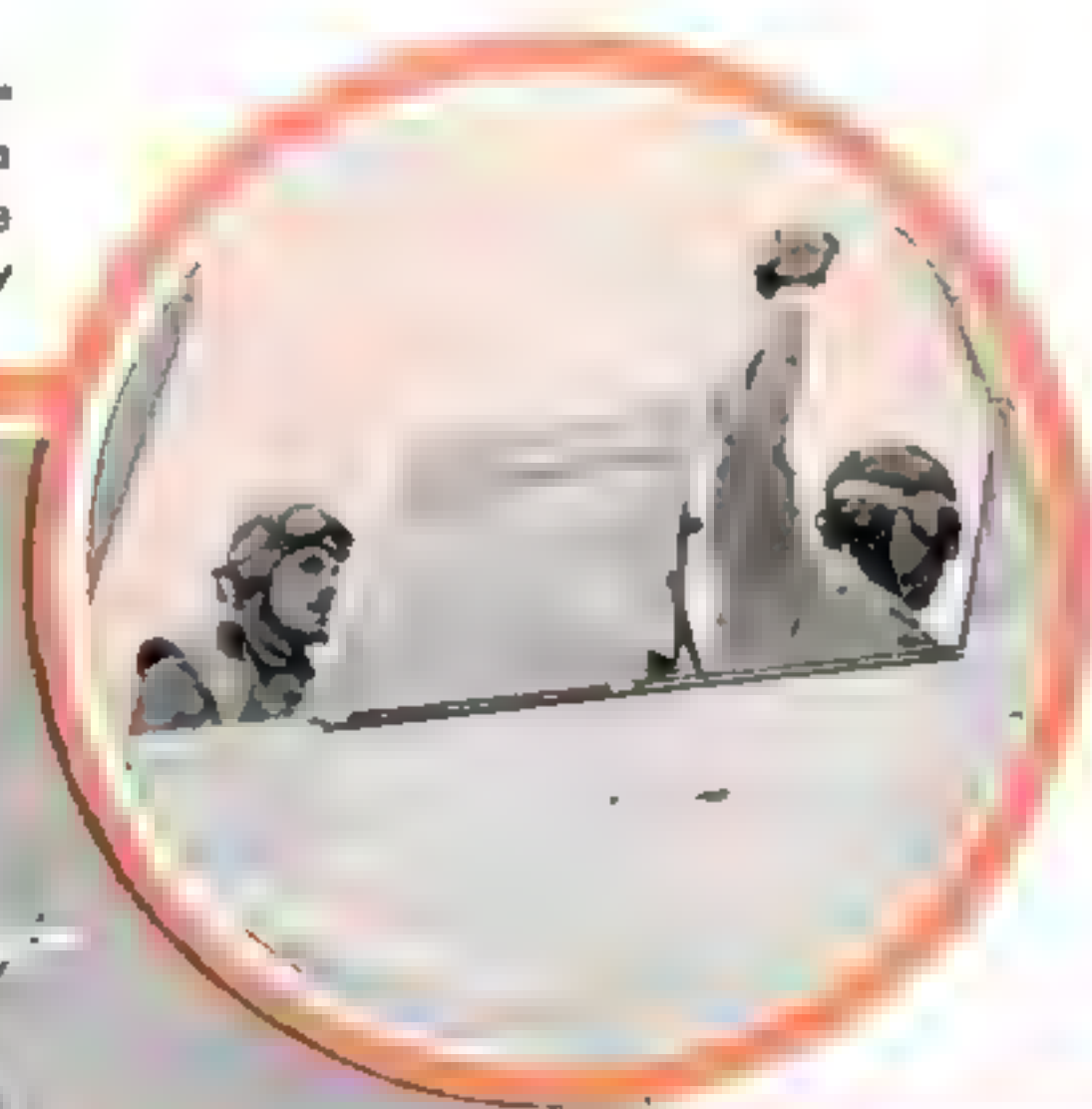
Ever since the closing days of the World War, the importance of formation flying has been given major consideration by Air

Corps officers. Early aces—like Rene Fonck, who shot down seventy-five enemy planes, and Georges Guynemer, with fifty-three victories to his credit—were lone eagles who achieved their triumphs in single combat. As the war progressed, and the airplane developed as a fighting tool, however, massed formations began to appear. Early in 1916, the "flying circus," led by Baron von Richtofen, started to set the pace on the Western Front. After the death of "The Red Knight," others carried on the idea of formation flying, notably Capt. Eddie Rickenbacker, leading Ameri-

can ace and commander of the 94th Pursuit Squadron. The war ended with the military value of massed air fighting soundly established.

How effective will bombing armadas be in the present conflict? Will they overturn naval strength? Will they blast openings through the modern Chinese Walls of fortification?

Raising his arm vertically overhead, the leader signals for a more complicated shift into the "echelon" formation seen below



When the leader's arm drops outside of his cockpit, the planes swing back into the "section V." Dotted lines show maneuvers



Orchard on One Tree



ONE TREE
ORCHARD

TAKE YOUR PICK
of apples, and it probably
grows on this tree. Some
144 grafts have been
made on it by its owner,
Major F. A. Good, left.
At right is a recent graft



THIRTEEN years ago, in 1926, Major Frank A. Good, instructor in agriculture at the Provincial Normal School, Fredericton, N. B., set out to produce a "one-tree orchard" as a living monument to the apple-growing industry of the province. He determined to graft every apple grown in New Brunswick on the branches of one tree. Choosing a sturdy wild-apple tree, which had grown from seed, he made seventeen grafts the first season. By the fall of 1930, the tree was bearing thirty-five different kinds of apples. Three years later, it produced fifty varieties. Each year since, Major Good has added more scions. Today,

his remarkable orchard on one tree represents 144 grafts and virtually every apple ever grown within the boundaries of New Brunswick can be found among the varicolored and many-flavored fruit which its branches produce each autumn. The work of grafting has been made more difficult by the severe winters of the region, when the thermometer often drops to forty and fifty degrees below zero. Among the familiar apples produced by the unique tree are Ben Davis, yellow transparent, northern spy, and Rome beauty. Some years, as many as four barrels of perfect apples are harvested from Major Good's concentrated orchard.

Engineer Is Walking Microphone Boom



Out of the televised scene himself, the engineer can keep the mike always near the sound source

STRAPPED to the back of a television engineer, an overhead boom of lightweight metal tubing carries a microphone that picks up the sound accompaniment for British television programs. In the example illustrated above, the "walking mike" is

bringing listeners an assorted selection of bleats from a sheep-shearing center. Ear-phones help the operator find the best position. Beside him, a television camera on a rolling truck is putting the actual scene on the air.



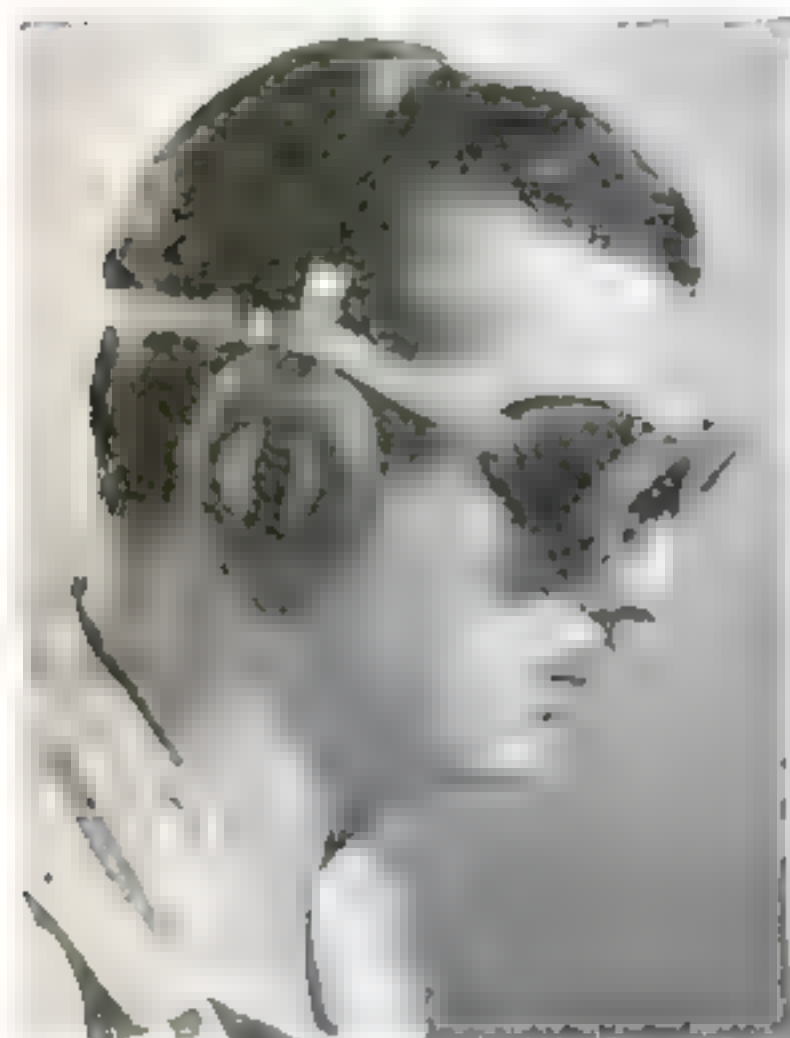
A switch on the megaphone is pressed to fire the starting gun

Megaphone Switch Fires Starting Gun

AN IMPROVED starting device for foot races, invented by a British scientist, has proved successful in recent tryouts. After giving the preliminary commands through his megaphone, the starter flips an electric switch attached to its handle. A battery fires the starting gun, mounted in a box on a standard. The invention complies with international sporting rules that the starting official must have the runners under his eye, and that the gun must be in a prescribed position relative to the runners. In the photograph at left, the box holding the gun is opened to show its mechanism.

Lightweight Ear Guards Protect Factory Workers

EARS as well as eyes are protected from flying bits of metal, wood chips, dust, and other factory hazards endangering workmen, by the combined safety goggles and ear muffs shown in the illustration. Con-



ventional safety goggles are fitted with the muffs, which weigh only two ounces and are held snugly in place by a springy steel head band. A fine metal screen in each ear opening allows sound to enter but bars small flying objects.



Fire Engine Makes a Transcontinental Trip

WHAT is believed to be the longest single run ever attempted by a vehicle of its type was made recently by the fire engine shown in the photograph above, which set out from New York City for a 4,000-mile tour of the United States from coast to coast.

New Loader Speeds Rail-Truck Service

TO SPEED UP freight service, a new system employs automatic loading mechanisms that can transfer loaded, half-carload freight containers between a special motor truck and a railroad flat car, within ninety

seconds. When a freight train arrives at its destination, a truck is brought alongside a flat car, a push button is pressed, and a twenty-ton container is automatically transferred to the truck for door delivery.



Special machinery slides the huge tank from the flat car to the truck trailer for speedy delivery



Mrs. Edel Torngren exhibits the yardstick model with which she worked out the idea of the walking doll above

Mother Invents a Walking Doll

"IF MY doll could only walk, Mother, she would be almost alive." So Mrs. Edel Torngren, of Grand Rapids, Mich., set out to make her daughter's wish come true. She succeeded so well that her invention of a "walking doll," on which patent rights have been granted her, may find the eye of a toy manufacturer and make her rich.

First in Copenhagen, Denmark, and then in this country, Mrs. Torngren had repaired children's dolls for years—so her husband, Hans, and her three children were confident she could teach one to walk. With them, she laughed and joked about her first crude model, cut from a yardstick—the "stick-bug," she called it—that embodied her idea. In her spare time, she perfected the design.

The result is a charming little doll that toddles gracefully along a table top or floor, when guided by a childish hand. As one leg goes backward, the other steps forward, propelled by levers and a loop of interconnecting cord. But dolls, like real people, must sometimes sit down. So gentle pressure operates an ingenious release for the walking mechanism, and both legs come forward in a sitting posture. Moreover, the doll can either stand or sit by itself. Among the thousands she has handled, Mrs. Torngren has never seen another doll of the "hard-bodied" kind so self-reliant.



When one foot is pushed backward, the other moves forward. To allow the doll to sit down, the walking mechanism can be released easily



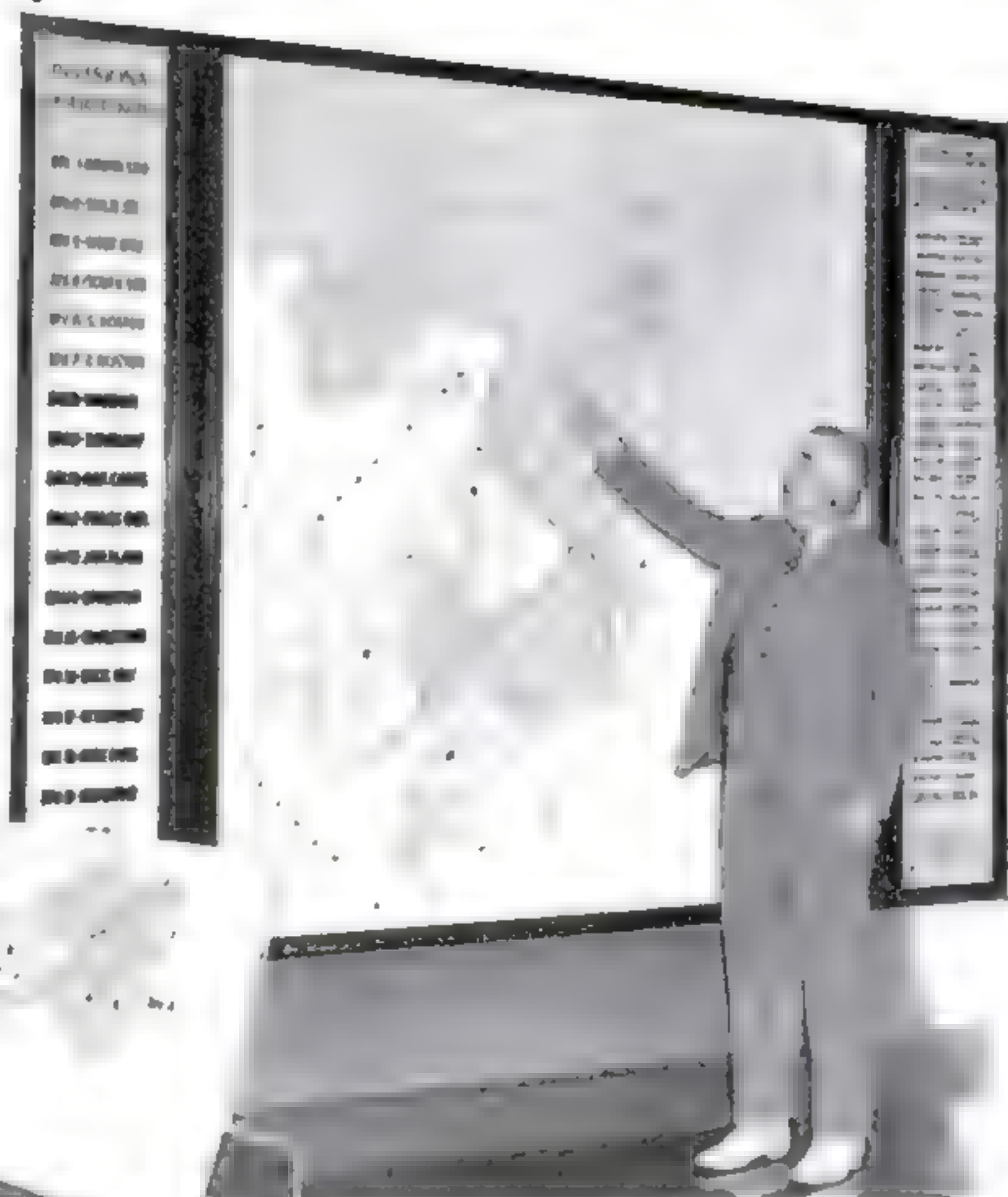
Grocer Builds Toy Village of Orange Crates

H. S. HOLSHUE, of Copley, Ohio, never lets the fact that he has been crippled since boyhood interfere with either business or pleasure. He has built up one of the most complete grocery stores in the state, and during his spare time he maneuvers around in his wheel chair adding new buildings to the seventy or more that comprise his remarkable midget village, made entirely from empty orange crates, apple boxes, and other food containers.

H. S. Holshue at work in the remarkable village he built in his back yard

"Crime Map" Keeps Police Head Posted

WHEN Joseph F. Timilty, police commissioner of Boston, Mass., arrives at his office each morning, he need not pore through written files to find what has happened during the night. Instead, lamps glow upon a large-scale map of Boston and its environs, to show the location of crimes, accidents, and police officers at a glance. The lights are controlled by punched cards prepared by Oscar Ely, the ingenious patrolman who devised the illuminated "scoreboard" and convinced superiors of its value.



A glance each morning at the tiny lights on the map informs Police Commissioner Timilty of Boston where crimes and accidents have occurred during the previous night. At left is Patrolman Ely, inventor of the map, at its control board

Polar Painter Brushes Up on Science

ONE of the 160 intrepid explorers who will make up the party led by Admiral Richard E. Byrd on a new expedition to the South Pole to stake out American claims to Antarctic territory (P.S.M., Nov. '39, p. 63), is a landscape painter, Leland Curtis, of Los Angeles, Calif., who will supplement the work of photographers in depicting the terrain of America's newest frontier. In preparation for the task, Curtis has engaged in extensive laboratory research work, to determine the effects of zero and sub-zero temperatures on oil paintings. The young explorer-artist is shown in his laboratory at the right.



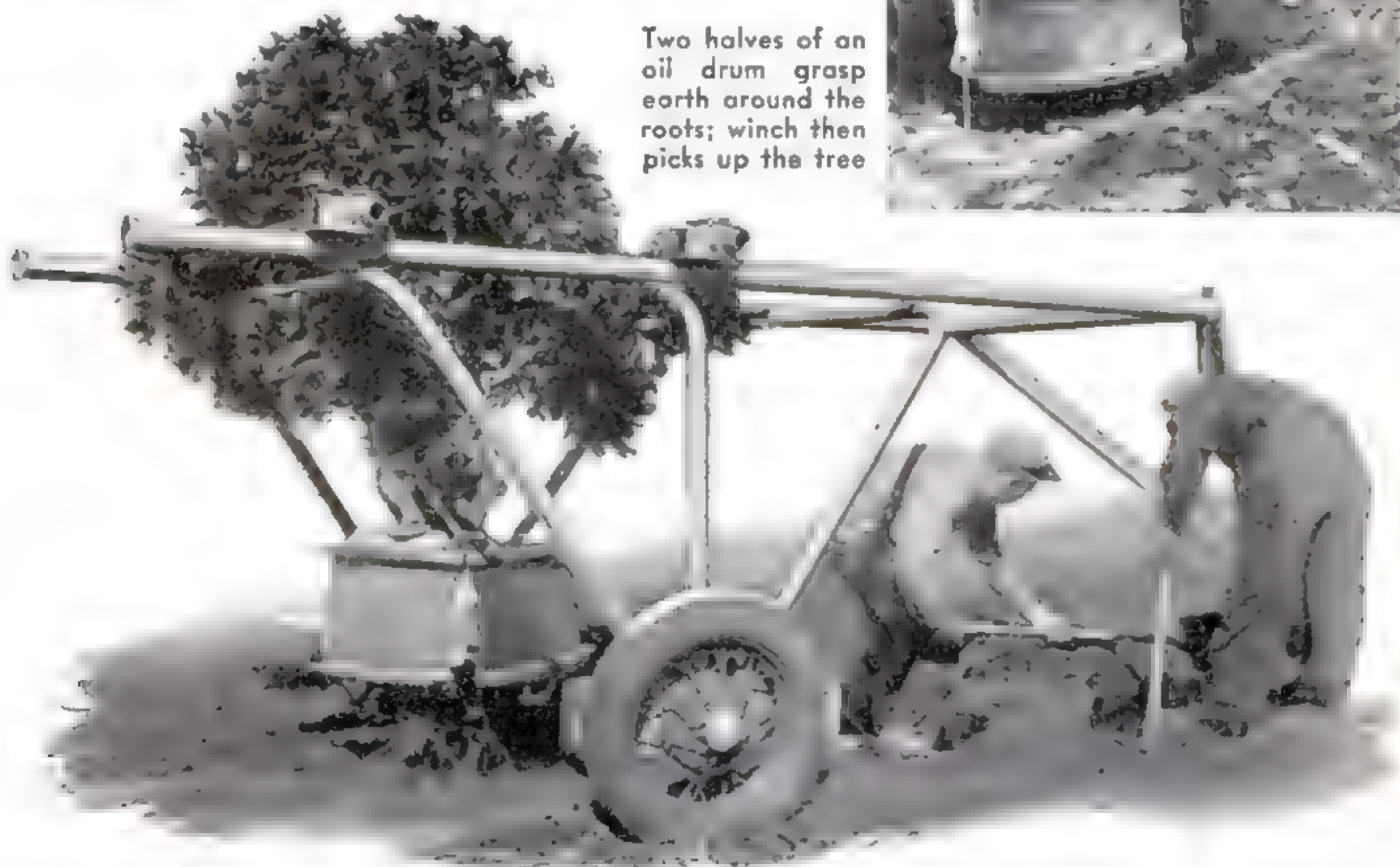
Leland Curtis studying the effects of extreme cold on oil paints

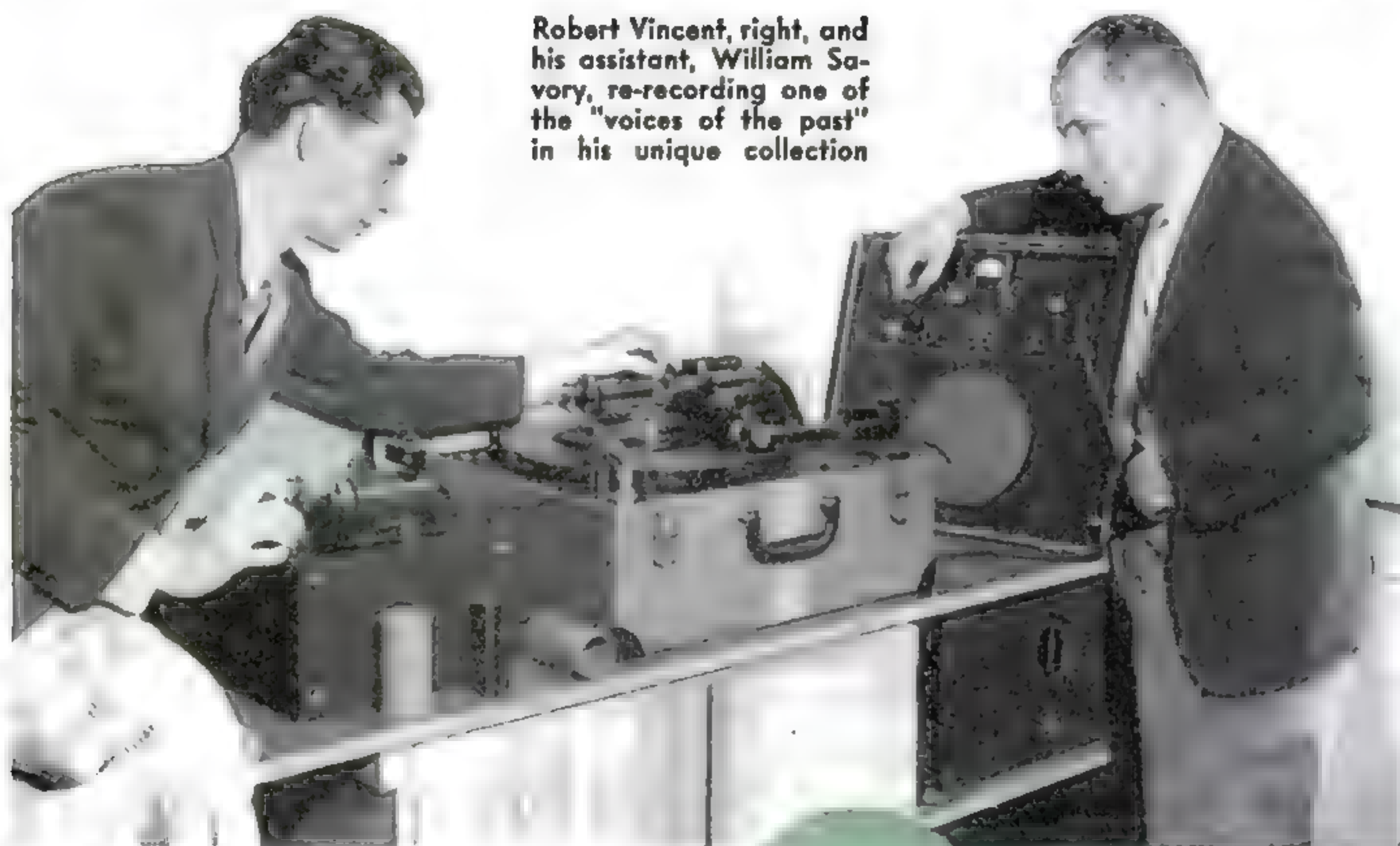
Homemade Three-Wheeled Crane Aids in Transplanting Trees

FOR transplanting orange trees, Ernie Thompson, of Strathmore, Calif., constructed the novel homemade tree mover pictured below. Suspended from a metal frame mounted on three rubber-tired wheels, split halves of an old steel oil drum are lowered on chains, placed around the exposed earth and roots surrounding a tree, and clamped together. Turning a crank on the frame lifts the tree for towing to a new location.



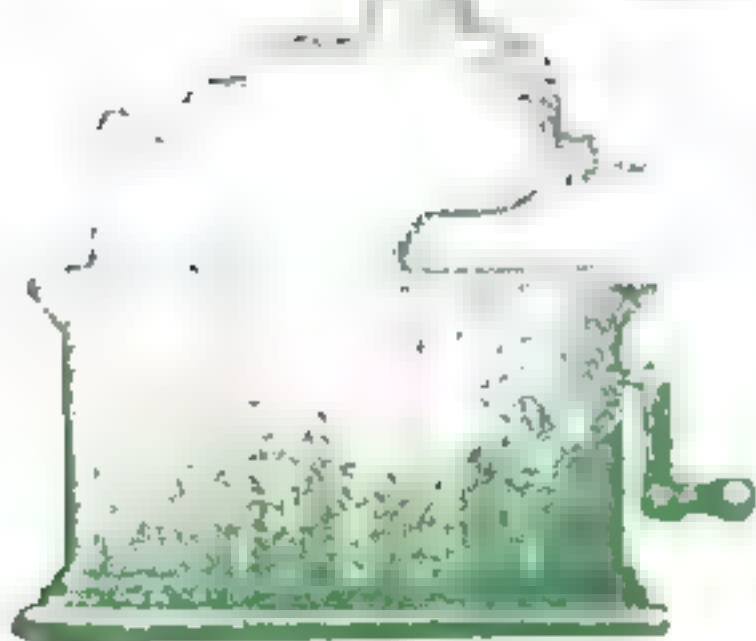
Two halves of an oil drum grasp earth around the roots; winch then picks up the tree





Robert Vincent, right, and his assistant, William Savory, re-recording one of the "voices of the past" in his unique collection

"Ghost" VOICES FORM ODD COLLECTION



SALVAGED from dusty attics and cluttered basements, more than half a thousand old-time phonograph records form the unique "voices of the past" collection of Robert Vincent, of New York City. William

E. Gladstone, English premier under Queen Victoria; P. T. Barnum, the great American showman; Henry M. Stanley, the explorer who found Livingstone; Robert E. Peary, discoverer of the North Pole; Thomas A. Edison, Theodore Roosevelt, and a host of other noted persons speak out of the past through Vincent's fascinating and historically invaluable file of old records.

As he plays them, you hear General John J. Pershing make an address to the American people from the battlefields of France; you hear the American statesman, William Jennings Bryan, give his celebrated "Cross of Gold" speech; you hear Florence Nightingale, patron saint

Here Vincent displays a case of the old-time cylinders that preserve the voices of the great



By EDWIN TEALE

of nursing, bid farewell to her comrades of the Crimean War; you hear the first telephone conversation between New York City and Washington, D. C.

Every president of the United States since Grover Cleveland is represented among the records of Vincent's collection. Rudolph Valentino, the movie idol; Sarah Bernhardt, the French actress; A. Conan Doyle, creator of Sherlock Holmes; Count Leo Tolstoy, the Russian writer; Emperor Franz Josef of Austria; General Nelson A. Miles, the Indian fighter, are also on the list. The voice of every member of Franklin D. Roosevelt's present cabinet has been recorded for posterity.

Vincent was only twelve years old when he obtained the first record of his collection. Theodore Roosevelt, unable to address a boy's club Vincent had organized near Oyster Bay, N. Y., recorded his speech on a phonograph record and sent it in his place. That historical cylinder, said to be the only authentic existing record of Roosevelt's voice, is the No. 1 item of Vincent's "library of voices."

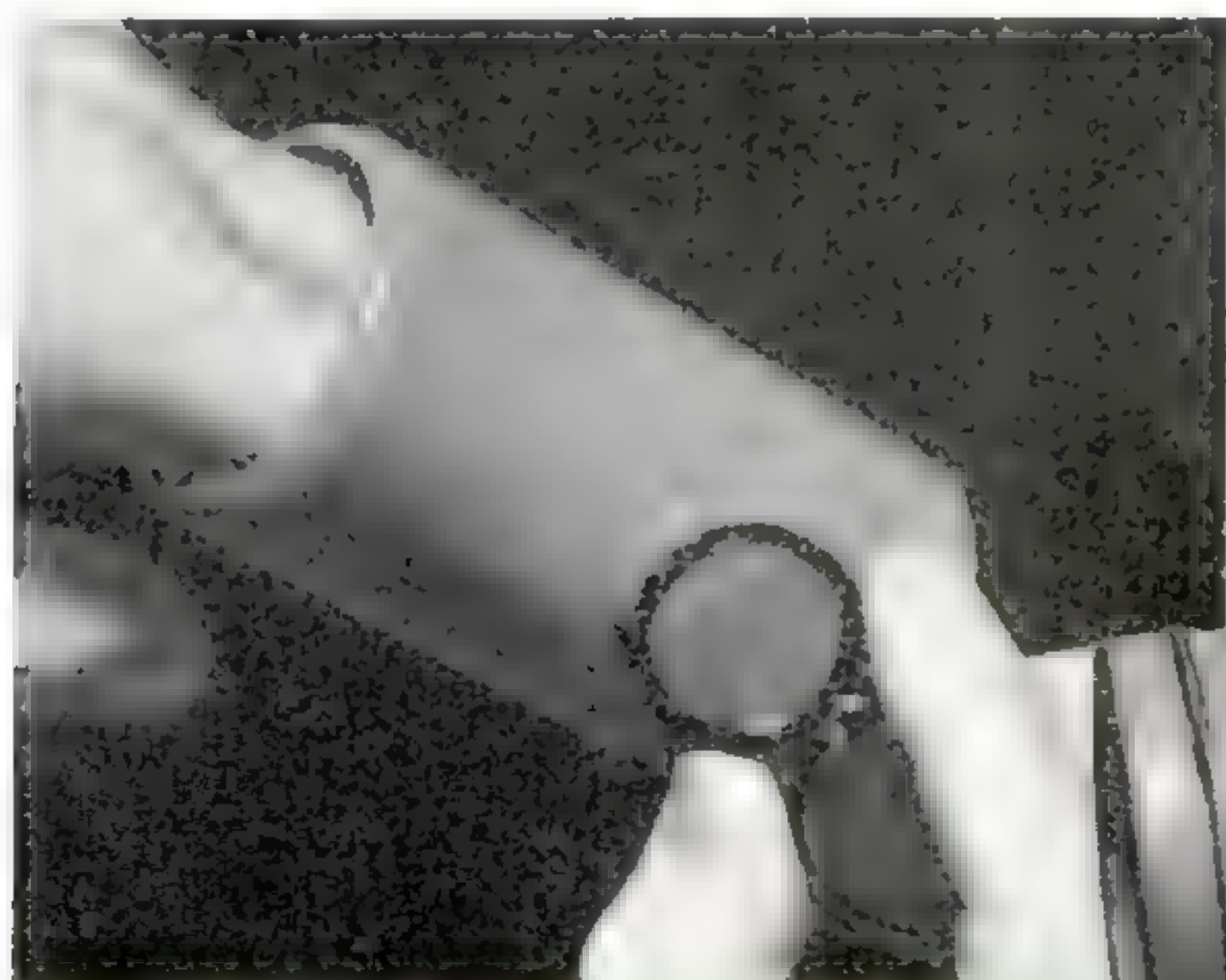
Working like a detective, Vincent spends his spare time tracking down forgotten phonograph records. These antiques in wax have come from Europe as well as from various parts of the United States. Almost every week, the collector adds some new treasure to his ever-expanding library.

First item in the collection was this record of a speech by Theodore Roosevelt to a boys' club



With the aid of an assistant, Vincent re-records the voices of the past on modern, permanent disks. Special problems, oftentimes, arise in connection with this work. The grooves on the different cylinder records vary and special sapphire needles, some $\frac{4}{1,000}$ of an inch in diameter and others only $\frac{4}{10,000}$ of an inch in diameter, have to be made for the re-recording. Sometimes the ancient records come in warped by heat, pitted by oxidation, nibbled by rats or mice, cracked from ill usage. Then, various tricks have to be resorted to to get the best reproduction of the 'ghost' voices on them.

When a record is cracked, fine wire or silk is wound tightly around the ends to hold it solid. If mold or oxidation has pitted the surface of a cylinder, mineral oil is rubbed in the depression to permit the needle to slide over without scratching. When a record is warped or "egg-shaped"



Examining an old cylinder to determine its condition before re-recording. At right, a cracked record bound tightly with fine wire



instead of round, the re-recording is done at one quarter normal speed to eliminate distortion. Speed is also varied to make the voice deeper or higher.

One record that brought manifold difficulties was an ancient "sleeve" cylinder made by the American humorist, Artemus Ward. The early wax records, like those on modern dictating machines, could be shaved off and used for other recordings. At first, they had to be returned to the Edison laboratories to have this done. An innovation which eliminated this trouble was a celluloid sleeve which could be put on over the cylinder, and on which an additional recording could be made. However, the innovation brought troubles of its own. The celluloid grew brittle and cracked and deteriorated with age. Vincent and his assistant, William Savory, worked for days before they licked the problems of re-recording from the half-century-old "sleeve" on a modern disk.

At present, Vincent is recording directly the voices of some of the celebrated people of today. The latest record of the sort is one of Dan Beard at the age of eighty-nine telling of the founding of the Boy Scouts of America.

Probably the most unusual record of historical interest in his collection is one that reproduces the call of the very bugle which sounded the charge of the Light Brigade at Balaklava, in the Crimean War. The record was made by Kenneth Landfrey, the trumpeter who sounded the charge made famous by Tennyson's poem. The same bugle had



Savory applies mineral oil to a spot eaten out of an old record by oxidation. The oil allows the needle to pass over the depression with a minimum of scratching

also been used by Wellington's army at the Battle of Waterloo.

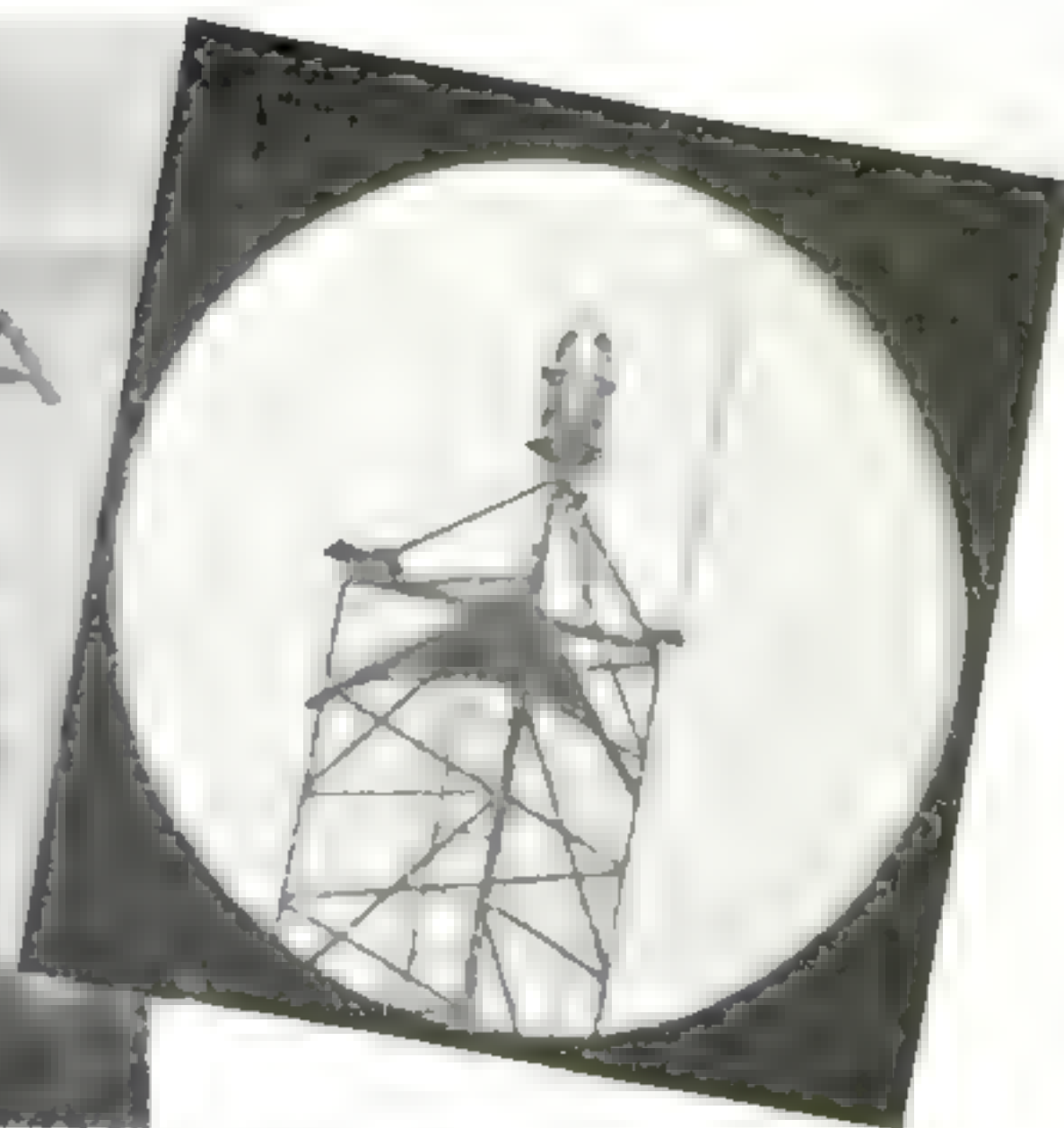
One windfall, which has given Vincent some of the best of his old-time records, came as the result of a "phonogram," a letter dictated on a phonograph record, which Edison sent to his London agent, Col. George E. Gouraud. The inventor asked his assistant to record the voices of several of the great men of the time. The resulting records, found among historical relics at the Edison works, have given Vincent the voices of Gladstone, Barnum, Florence Nightingale, and others.

Years before Vincent was born, Thomas A. Edison was asked by the editor of the *North American Review* to write an article giving his conception of the value of his latest invention, the phonograph. The article, which appeared in 1878, said in part: "It will henceforth be possible to preserve for future generations, the voices as well as the words of our Washingtons, our Lincolns, and our Gladstones." His prediction is becoming reality in Vincent's collection.



Vincent's re-recording apparatus in operation. "Ghost" voices on the historic cylinders are transferred to modern, permanent disks

Camera Fan Gets Long-Distance Shot



Top of a 750-foot mast, magnified 250 times the camera's normal view by the set-up at the left

ALTHOUGH few persons have ever had a close-up view of the top of the 710-foot antenna tower of radio station KDKA, Pittsburgh, Pa., Byron McGill, National Broadcasting Company official, can show you exactly what it looks like. An amateur photographer, McGill hooked a camera to a

four-inch astronomical refractor telescope fitted with a high-power eyepiece to give a magnification of 250. Aiming the telescope at the top of the antenna tower with the aid of a smaller glass, he snapped the picture reproduced above, plainly showing the air beacon and lightning rod that cap the mast.



Through the two-way mike and speaker, the dock dispatcher and incoming-barge captains can converse to speed barge landings

Dock-To-Boat Communicator Speeds Landing of Barges

MOUNTED on a post near the water's edge at the Hudson River docks of an oil company in Albany, N. Y., a loudspeaker facilitates two-way communication between captains of incoming oil barges and the dispatcher in the dock office. The unit serves as both a loudspeaker and a microphone, picking up the captain's words and returning the dispatcher's.



Chickens Tattooed To Foil Thieves



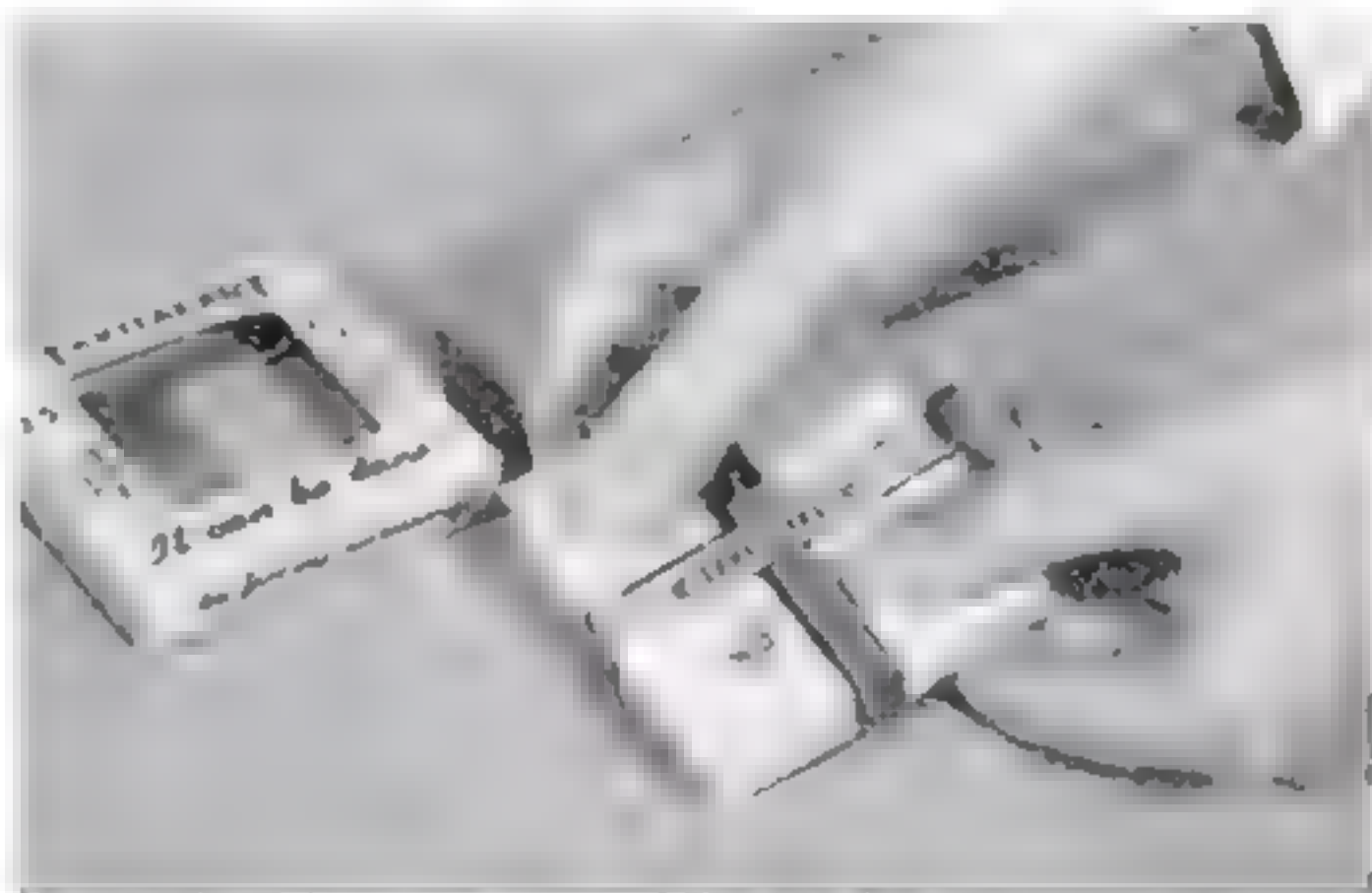
Tattooing the owner's number on a chicken's wing. A close-up of the operation is seen at the left. A reflector sign warns night prowlers that poultry has been registered

TATTOOING numbers on the wings of poultry has proved a valuable aid to farmers in eastern states, as a means of foiling chicken thieves. By means of punches composed of sharp needles arranged to form the numbers, indelible ink

is inserted in the webbing of the wing back of the bone, making a permanent mark. Each farmer registers his individual number with the state police. In the event of theft, the number is reported and a watch is kept at produce markets for the stolen birds. Signs, equipped with reflectors so they can be seen at night, are posted in front of each farm using the protective method, warning that the chickens are tattooed.

Take This Puzzle Apart, and You Get a Penny

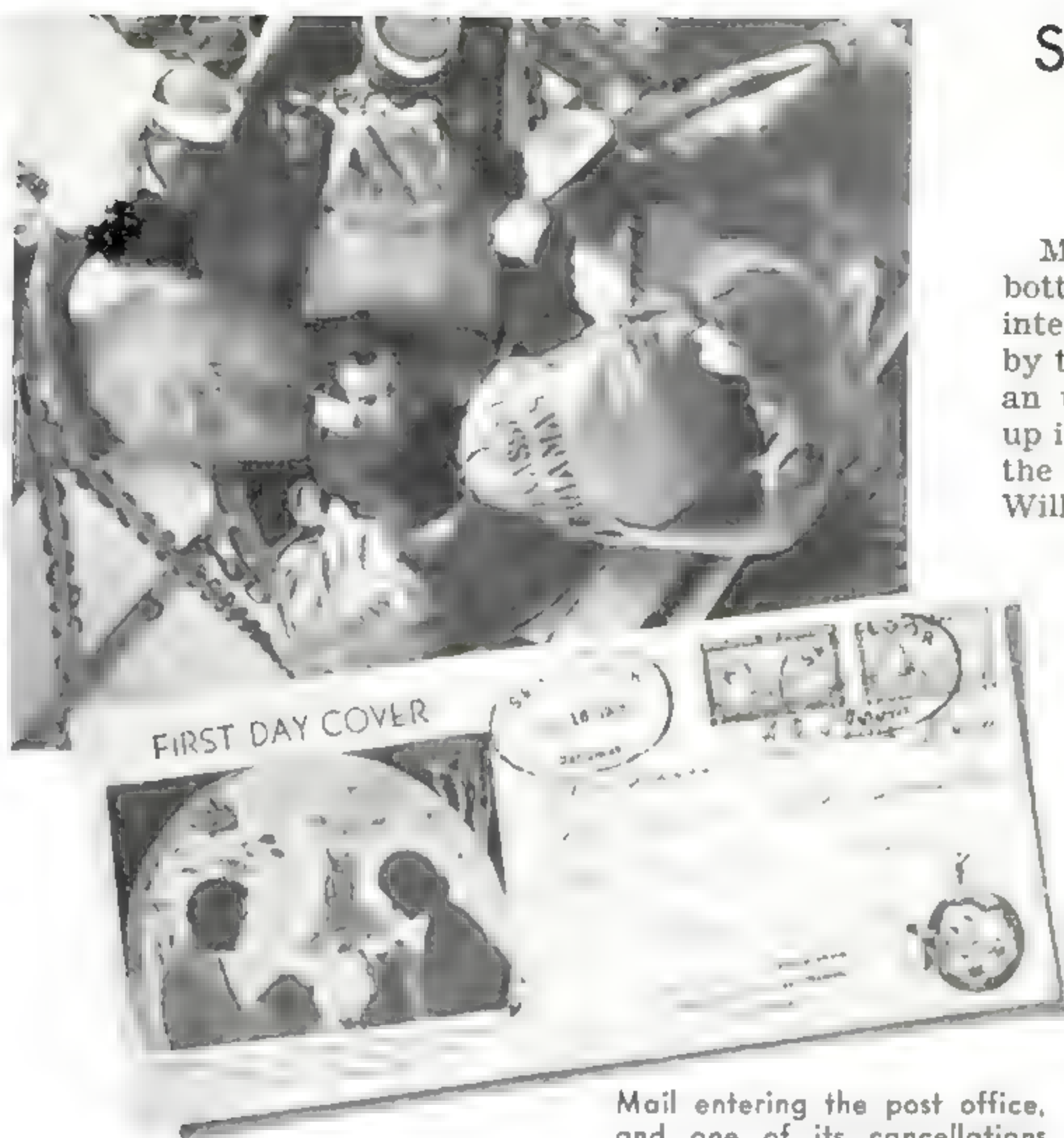
A PUZZLE with a cash reward is an innovation in entertainment devices. The puzzle is formed of ten pieces of wood—four pieces with square corners, two crossbars, and four round pegs. A hole drilled into one of the corner pieces permits the person working the puzzle to see a shiny new penny inside. If he can separate the ten pieces of wood, he gets the penny. No forcing is said to be necessary to take the puzzle apart and claim the reward.



Seen through a hole in one of the pieces of wood, a penny offers a reward for taking this puzzle apart

Stamp Fans Get Sea-Bottom Post Office

MAIL your letters from the bottom of the sea. That is the interesting possibility offered by the recent establishment of an underwater post office set up in the photosphere in which the veteran explorer John E. Williamson is making studies of underwater life near Nassau, in the Bahama Islands. On the first day of mail service, the underwater post office was swamped with letters from stamp collectors, and clerks worked far into the night carrying sacks of mail down into the metal sphere, post-marking them in the submarine office, and carting them up to the surface again for dispatch to their destination.

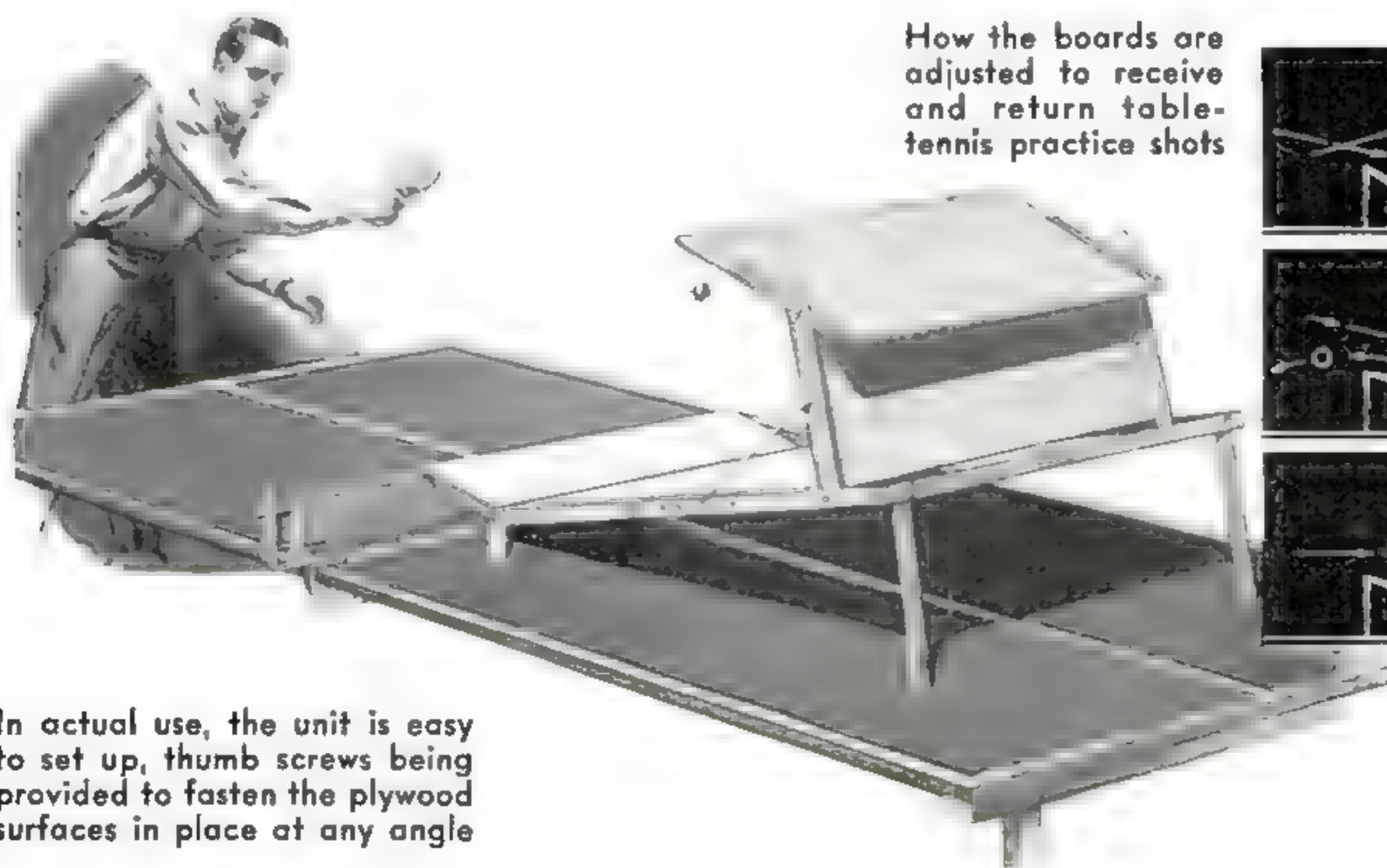


Mail entering the post office, and one of its cancellations

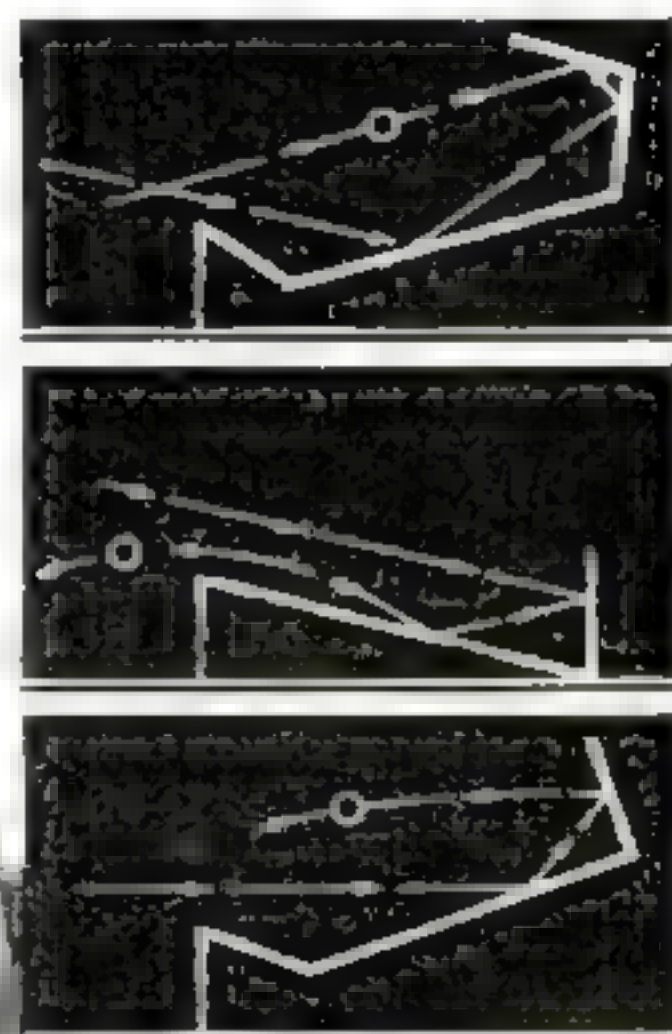
Practice Board for Table-Tennis Players

TABLE-TENNIS enthusiasts now can practice and polish up their strokes with an ingeniously simple mechanical opponent invented by Harold W. Frost, of Worcester, Mass. The device, made of boards hinged together so that they can be adjusted to different angles, is set up on one side of the

table. Balls hitting it rebound back into the practicer's court, as shown below. When properly adjusted, the inventor claims, the device will return the ball within bounds no matter at what angle it is hit. By changing the angle of the boards, the player may set the device to return any type stroke.



How the boards are adjusted to receive and return table-tennis practice shots



In actual use, the unit is easy to set up, thumb screws being provided to fasten the plywood surfaces in place at any angle

Hospital Infants Get Own "Apartments"



In the air-conditioned nursery of a Portland, Ore., hospital, each baby has private quarters, as at the left

At feeding time, babies are brought to the mothers in stainless-steel trays



SURROUNDED by transparent walls of unbreakable plastic composition, new-born babies in the Sanitarium Hospital, Portland, Ore., live in tiny individual apartments where the air is completely changed every three minutes, and the temperature is maintained constantly at seventy-four degrees F. Proud fathers may view their offspring through plate-glass windows, and may even coo parental baby talk to them by means of a loudspeaker system.



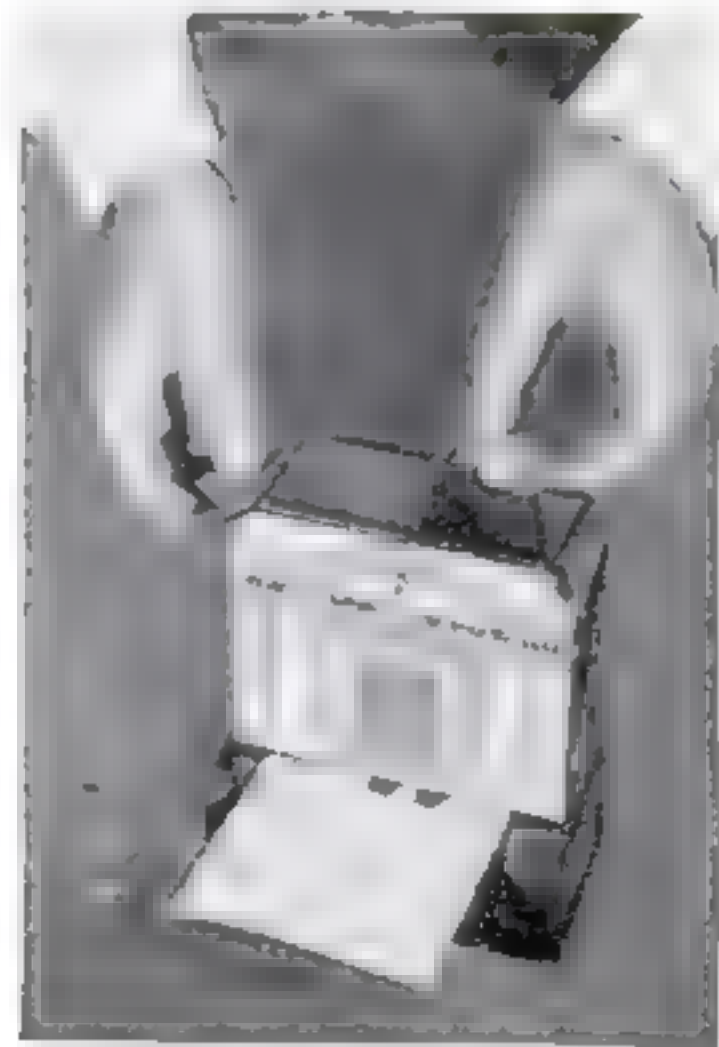
Note circular trap where any metal scraps picked up are kept from reaching the fan

Vacuum-Cleaner Attachment Recovers Scrap Metal

BY THE use of a small trap attachment, portable vacuum cleaners can be used for cleaning out shelves and compartments containing nuts, screws, and other small parts, in a machine shop or factory. With the attachment, dust and dirt are sucked into the cleaner's dust bag, while any metal objects drawn into the cleaning nozzle are caught in the trap where they can be recovered.

Toy Bank Records Deposits

WHEN a coin is dropped into the slot of a new toy savings bank, an inked rubber stamp moves into place over a special deposit book inserted through the front of the metal box. Pushing a lever presses down the rubber stamp to record the amount of the deposit in the book. By providing a visible record, the bank is said to encourage saving.





Foot Cornstalk Cutter Leaves the Hands Free

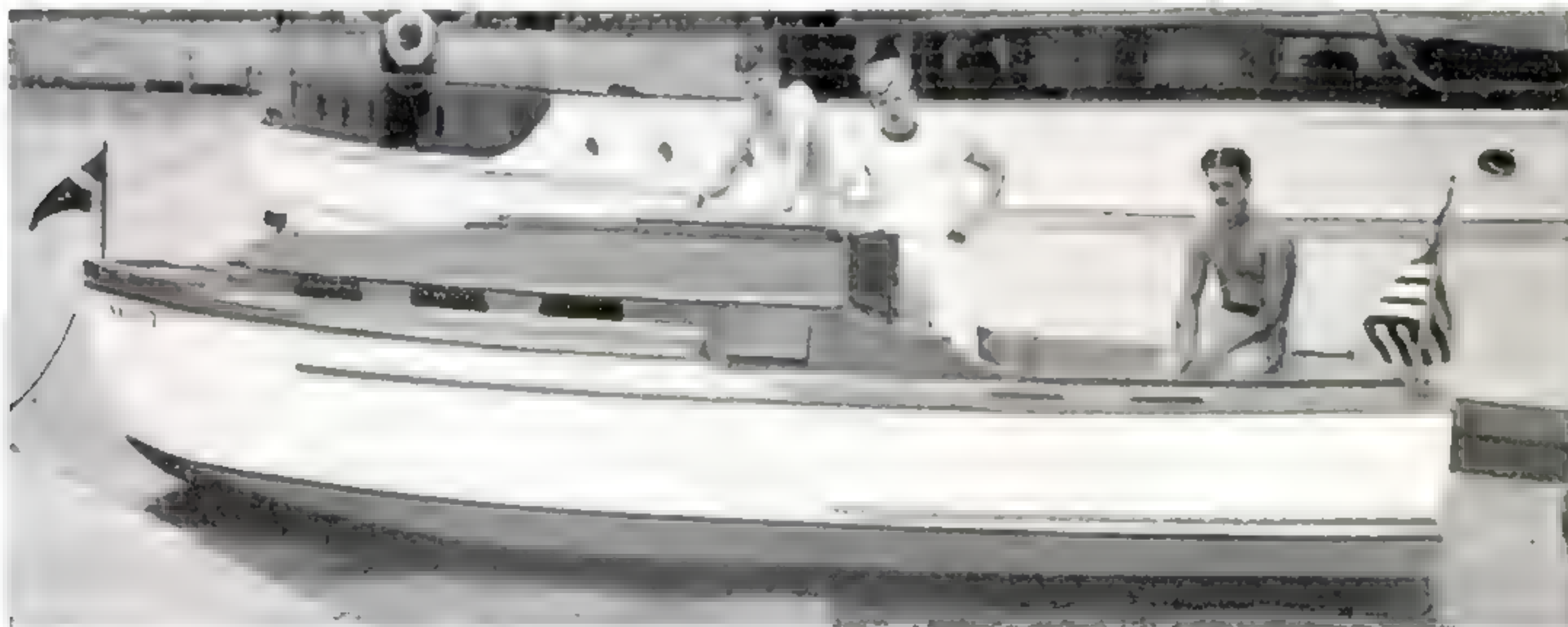
HARVESTING field corn or sugar cane is simplified by a novel cutter invented by F. W. Tappen, of Burzaco, Argentina. Bolted to a shoe, the tool is made of steel in the shape of a Y, with the inside edges sharpened. As the harvester walks along a row, he kicks at the base of each stalk, slicing it off cleanly. Both hands are thus left free for piling the stalks.

Plane Fire Extinguisher Works Automatically

AUTOMATIC fire extinguishers, which operate instantaneously in the event of a crash, are being installed in all British military airplanes. A suspended weight reacts to any abnormal shock, releasing a stream of fire-quenching methyl bromide gas.

Boy Builders Plan Long Trip in P.S.M. Cabin Cruiser

FROM plans published in POPULAR SCIENCE MONTHLY, three Buffalo, N. Y., youths, Clifford F. Baker, Jr., 16, C. Morgan Epes, 16, and John Ehinger, Jr., 15, constructed the trim outboard-powered motor boat pictured in the photographs below and at the right. Constructed in the Ehinger family garage, the craft measures seventeen feet in length, six feet in width, and has a ten-inch draft. Resinous plywood was the wood used for the hull, which was trimmed with mahogany and finally painted green and white. Christened *Sea Wolf*, the boat cost about \$150 for materials and is powered by a sixteen-horsepower outboard motor. Soon the trio hope to pilot their craft to New York City, by way of the New York State Barge Canal and the Hudson River.



Clifford F. Baker, Jr., John Ehinger, Jr., and C. Morgan Epes in their seventeen-foot cabin cruiser

Collectors Go for Airline Labels



Airline labels are collected like postage stamps. Below are examples of the colorful trophies of this novel hobby

AIRLINE luggage labels, similar to the stickers placed on passengers' baggage by steamship companies, have been added to the long list of things collected by hobbyists. Already there are said to be 10,000 enthusiasts who boast valuable collections, several of them containing more than 1,000 items. One of the great fascinations of the new hobby is the fact that some sudden turn of events may give a commonplace label unexpected value. For example, when the dirigible *Hindenburg* burned at Lakehurst, N.J., in 1937, its luggage-label price skyrocketed overnight. Again, with the dismemberment of Czechoslovakia, the value of the picturesque label of the Czechoslovak State Airlines shown above at the right zoomed to about twenty dollars. Already dealers in many cities are supplying assorted collections for beginners, and catalogs like those issued for stamp collectors have appeared. Experts now estimate the number of label issues at 2,000.





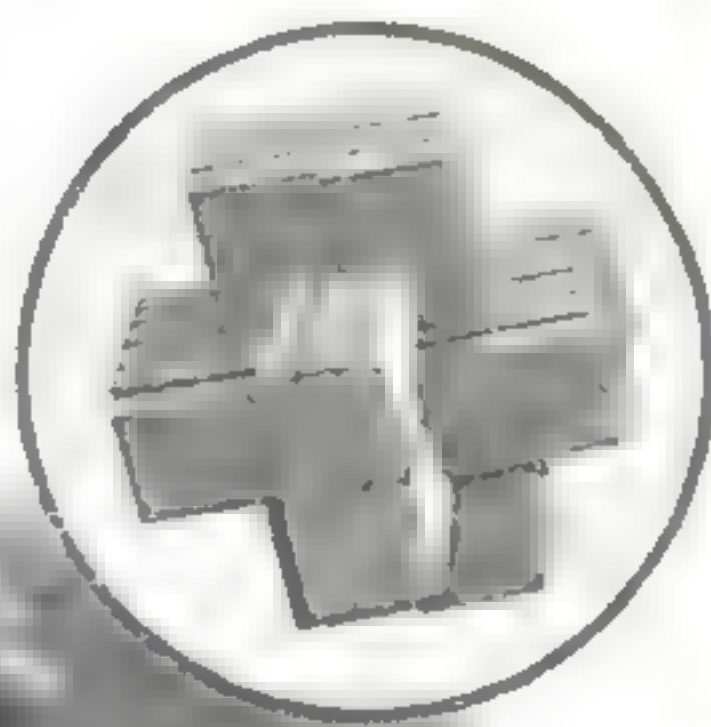
Ski-Equipped Stretchers Used by Alpine Troops

ACROSS snow-covered stretches of the upper Alps, Italian troops recently demonstrated the latest equipment for fighting on high-altitude battlefields. One of the innovations which was given a tryout by the mountain fighters was a stretcher on skis. Mounted on the stretcher sled through a system of pivoted levers like the pantograph on an electric locomotive, the ski runners automatically adjust themselves either up or down to suit the terrain. Such outfits enable wounded men to be transported swiftly down the slopes to base hospitals for treatment. Snowshoes and skis form part of the regular equipment of these Alpine troops.



Lowering a "wounded" soldier gently. Note how the ski legs adjust for crossing the side of a slope

While resembling the wooden Chinese-cross puzzles, it is of metal and harder to solve

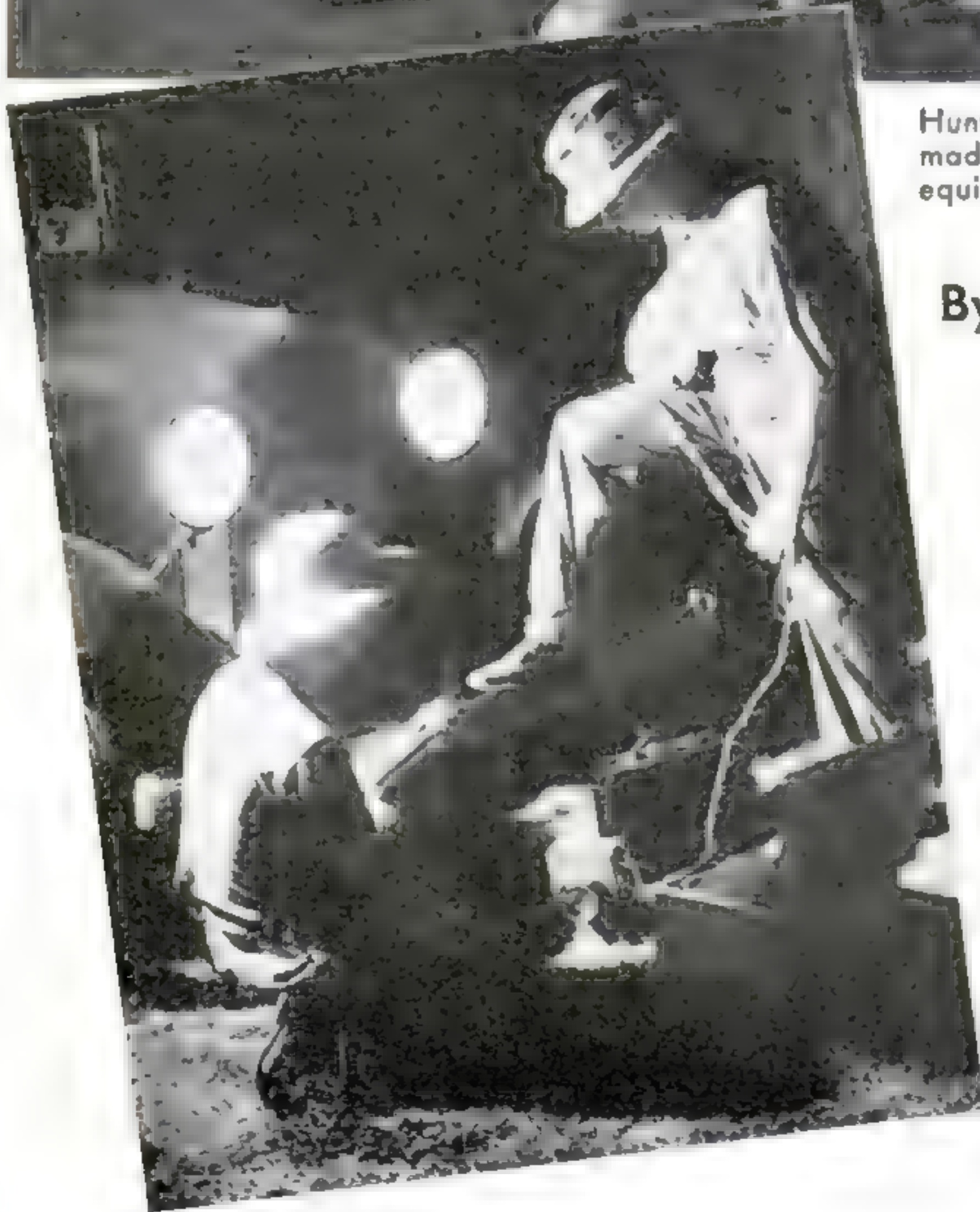


Chinese-Cross Puzzle Puzzles Crack Puzzlers

EXPERT puzzlers have been baffled by the complicated interlocking puzzle devised by Wilfred Hallock, of Huntington Station, N. Y. Suggesting in its shape the familiar wooden Chinese-cross puzzle, Hallock's mechanical teaser is formed of pieces of brass. Ordinary puzzles of the kind have only six pieces, while Hallock's puzzle consists of eighteen sections.

Night Prospecting...

A NEW HOBBY FOR AMATEUR MINERALOGISTS



Hunting for fluorescent minerals with a home-made ultra-violet torch. Left, rigging up equipment for night prospecting in the field

By **STERLING GLEASON**

SQUATTING in the darkness at the edge of an unfinished highway in New Jersey, a lone man humped over a gravel pile left by the road builders. In his hand he held a long-barreled, nickel-plated flash light, and though its dim, purple beam was virtually invisible, he was flashing it methodically, back and forth, over the heaped-up rocks.

Suddenly a brilliant sparkle of green leaped from among the rubble. Picking up a small fragment of rock, the man held it directly under the torch and saw it glow like an emerald with blazing internal fires. It was a calcite crystal, one of nearly 100 kinds of rock possessing the strange property of "fluorescing," or glowing under

the rays of ultra-violet light.

Night prospecting, a new hobby that is gaining widespread popularity, has brought interesting mineral discoveries to light. Some of them prove valuable as collectors' rarities, others are sought by prospectors for commercial purposes. One man, a technically trained specialist, has already spent many months combing the California desert for the telltale glow that will reveal outcroppings of scheelite, ore from which tungsten is extracted. Working only at night, he moves rapidly over the ground, letting his high-powered mercury-vapor lamp shine ahead of him as he walks. Now and then a false glow deceives him, as the torch shines on a tooth or the whitened bones of a desert animal. Occasionally the glow suddenly scuttles off at his approach, for scorpions, too, are fluorescent. But more than once the invisible ultra-violet rays have suddenly flared back in a brilliant blue blaze as they revealed a deposit of valuable ore among the barren rocks.

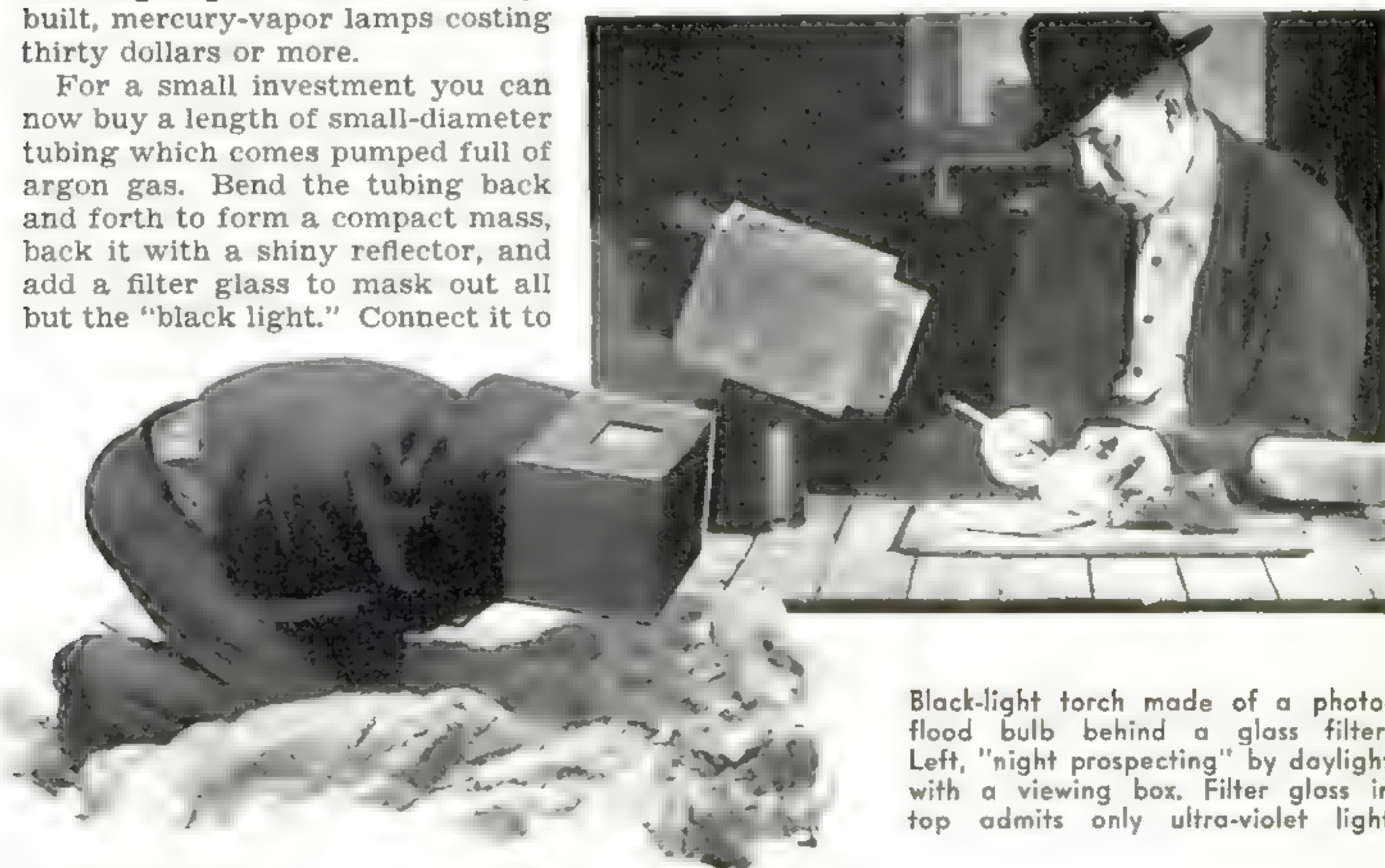
Fluorescence is caused by a mineral's ability to slow down the ultrafast, "black light" vibrations to the speed of visible-color light. Today the list of known fluorescent minerals is steadily growing with the development of inexpensive black-light torches which the amateur prospector can afford. These devices range from clusters of fifty-cent argon glow bulbs to factory-built, mercury-vapor lamps costing thirty dollars or more.

For a small investment you can now buy a length of small-diameter tubing which comes pumped full of argon gas. Bend the tubing back and forth to form a compact mass, back it with a shiny reflector, and add a filter glass to mask out all but the "black light." Connect it to



An amateur mineralogist with his specimen cabinets and black-light museum. Fifty-cent argon bulbs supply ultra-violet light

a Ford spark coil powered by dry cells and you have a good "cold quartz" lamp rich in ultra-violet rays. Or send high voltage from a spark coil or transformer crackling across a gap made of two nails spaced a fraction of an inch apart, and add a filter to absorb all visible light. Still simpler, mask an ordinary five-cell flash light such as hunters use, by replacing the lens with a circle cut from a deep-violet filter glass, costing a couple of dollars at optical supply houses. Now all you need is a dark night and a rock pile, for fluorescent minerals, though not plentiful, are found in nearly every state in the union. Rock piles, gravel banks, quarries, stream



Black-light torch made of a photo-flood bulb behind a glass filter. Left, "night prospecting" by daylight with a viewing box. Filter glass in top admits only ultra-violet light

beds, and lake shores are likely spots, although your own back yard may contain many things that respond to black light.

Not all black-light prospecting is done at night, however. Some amateurs rig up a darkened viewing box by cutting a hole in the top of an old box, taping a square filter glass over the opening to admit only ultra-violet rays, and using the opened flaps as a peephole through which they view the minerals to test them for fluorescence. Thus some of them are building up collections of minerals endowed with dramatic properties.

PROBABLY few collectors' items so lend themselves to judicious showmanship as the fluorescent minerals. In one amateur's home museum, specimens are mounted on black velvet in a cabinet equipped with a two-way switch. Under ordinary electric light the minerals are chunks of drab, ordinary-looking rock; but as he switches over to the ultra-violet lamp, the darkened cabinet suddenly seems filled with gleaming jewels and softly glowing, moss-covered stones.

Another enthusiast heavily charges his specimens by a barrage of sparks leaping between iron electrodes. His fluorescent minerals stand out as if traced in fire and the phosphorescent rocks glow for minutes afterward.

Amateur gem collectors turn their apparatus to another and important use, for it can be used to detect imitation jewels. Genuine rubies, for instance, fluoresce a very distinctive, deep-wine red, while synthetic rubies show a much lighter color. Pearls from a given locality always have the same color, while synthetic or cultivated pearls show other peculiarities which to experienced eyes quickly become apparent under the ultra-violet light. Some

diamonds fluoresce brilliantly, some faintly, some not at all, and their colors range from pink through orange, yellow-green, blue, and violet. Zircon, closely resembling the diamond, fluoresces a distinctive red which even a layman can easily identify. Natural amber fluoresces a bright green, while plastic imitations respond only dully, if at all. Common substances, too, undergo strange transformations. Kerosene looks blue, as do aspirin and oleomargarine, whereas butter always is yellow.

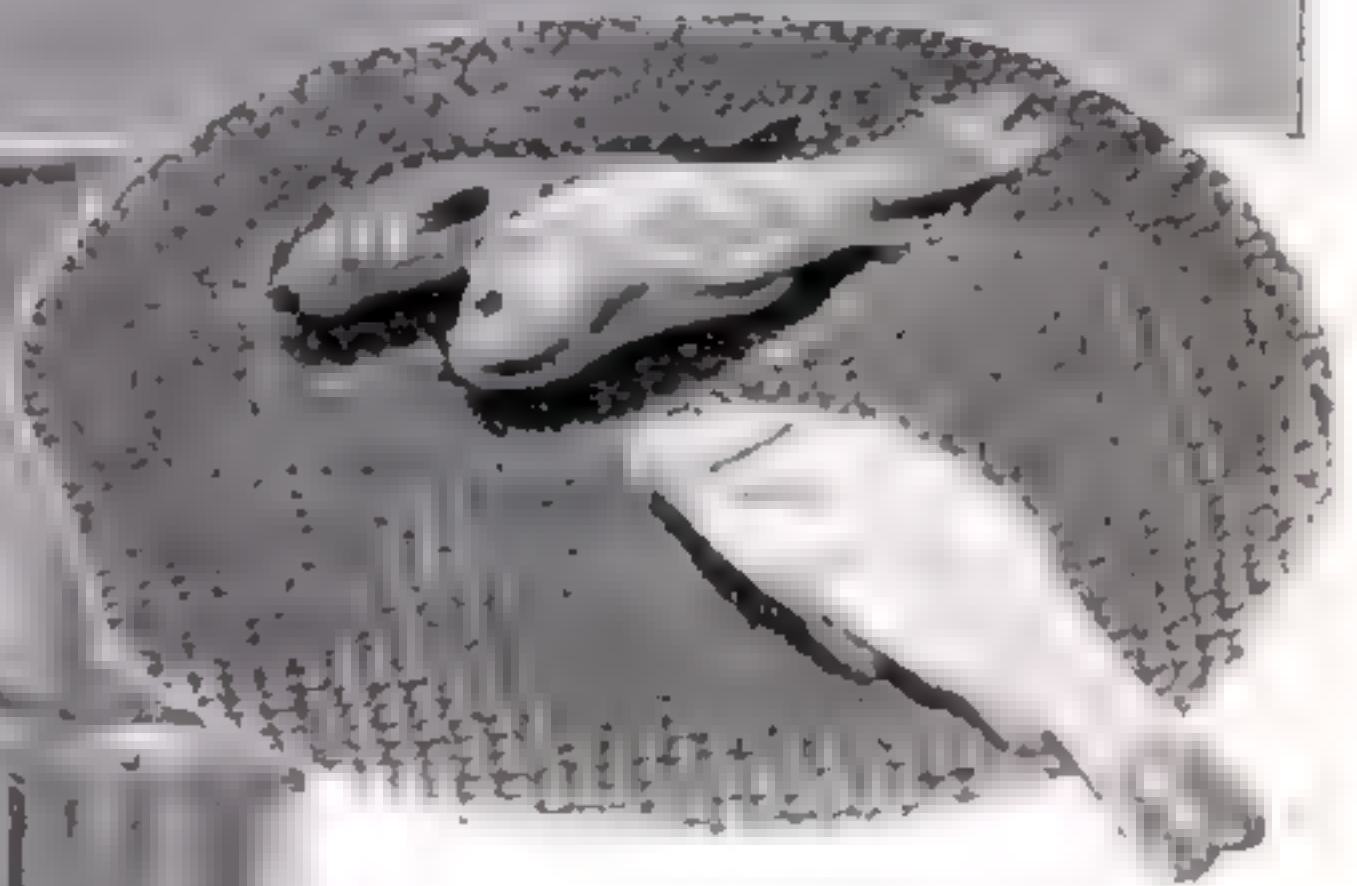
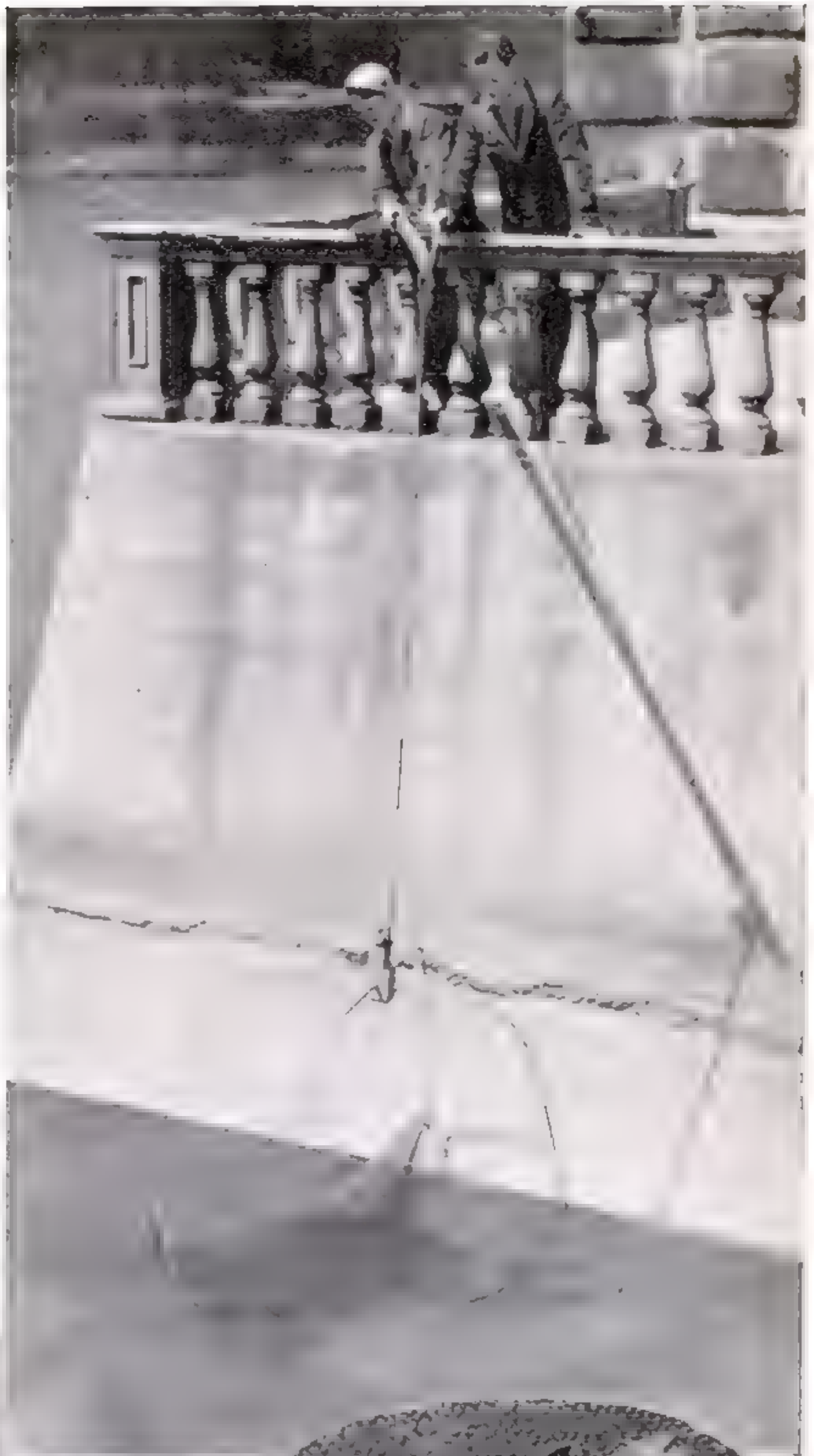
One of the biggest thrills in amateur prospecting is to discover a radioactive mineral. Such a mineral will discharge the electroscope, a simple instrument made of twin leaves of very thin aluminum foil forking from a single insulated mounting. Charge it by rubbing a comb with silk and touching it to the mounting, and the leaves repel each other, standing stiffly apart; but bring a radioactive mineral near and the invisible bullets radiating from it dissipate the static charge, letting the leaves drop together again. A more interesting experiment is to make such a mineral take its own self-portrait. Recently a Wyoming amateur prospector found some moss agates spotted with bright yellow patches of an unknown substance. Curious, he set it on top of a photographic film well sealed with black paper. Weeks later he developed the film and saw a clear picture of the stone, its bright patches etched neatly into the emulsion by their own radiumlike emanations!



Two leaves of aluminum foil, a piece of wire, and a bottle make an electroscope that will detect radioactive minerals. Left, another type

Aquarium Finds "Goldfish Mine" at Its Door

ALL the goldfish on display in the Franklin Park Aquarium in Philadelphia, Pa., have been fished out of the Schuylkill River flowing by the Aquarium's front door, although these household pets are not and never have been native to the river. The explanation of this curious fact is that hundreds of pet goldfish are lost down the drains of kitchen and bathroom sinks during periodic cleaning of their tanks. Wriggling out through drainage pipes, the fish are carried into the sewage system and eventually find themselves in the Schuylkill. If their underground swim through the sewer to its outlet is long, the fish have little chance to survive, but if short, their chances are excellent. Once in the open water, the surviving goldfish grow to large size: Anglers have often caught goldfish that tipped the scales at ten pounds, it is said. At the right, members of the aquarium staff are shown using a net to retrieve pet goldfish from the waters of the Schuylkill.



How the Franklin Park Aquarium gets goldfish from the Schuylkill River. At left, how the river gets its goldfish, via sink drains and Philadelphia sewers

Dare-Devil Cyclist



Crash! Through quarter-inch plate glass, Ken Butler hurls his machine. Left, the lightning approach

WITH shattered glass swirling around him; with splintered timbers filling the air over his head; with twenty-foot streamers of flame billowing about his motor cycle, Ken Butler, crash king of the carnival thrill riders, has dared death for years to provide spine-tingling excitement for the crowd. He hits plate glass a quarter of an inch thick at a mile a minute. He crashes at seventy miles an hour into a plank barricade. He roars through a tunnel of flame, fifteen feet long, steering with one hand.

His "crash rodeo," however, is more than an exhibition of nerve. It is a demonstra-

tion of precise planning and of the value of mechanical safeguards. For gadgets play a stellar role in his escapes from death.

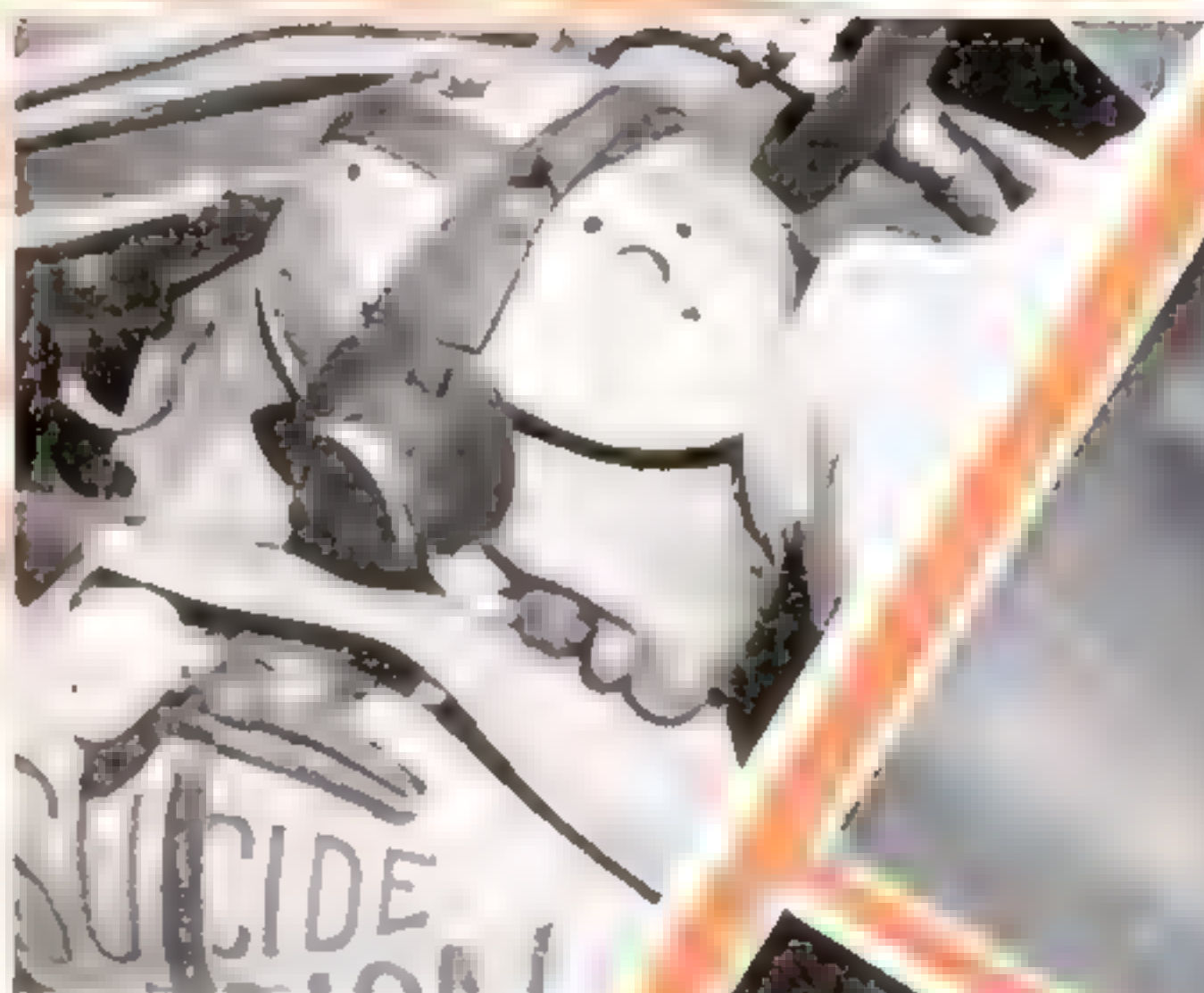
Before every ride, Butler's motor cycle is groomed by expert mechanics. To provide better control and quicker get-aways, lengths of motor-cycle drive chain are attached to the rear wheel in the form of nonskid links. An endless loop of similar chain prevents a side car from tearing away if a regular connecting bar should break when a double-rider exhibition is given. Metal shields, like the guards on rapiers, protect Butler's hands from flying debris, and cushioning buffers of tape, four inches in diameter, within these guards, help absorb the shock of impacts.

Twice Butler had his handlebars wiped away in crashing through barriers of plank. In the hospital, where he was sent by the resulting spills, he worked out a scheme for strengthening the steering gear. Now, before every run, a pair of heavy turnbuckles

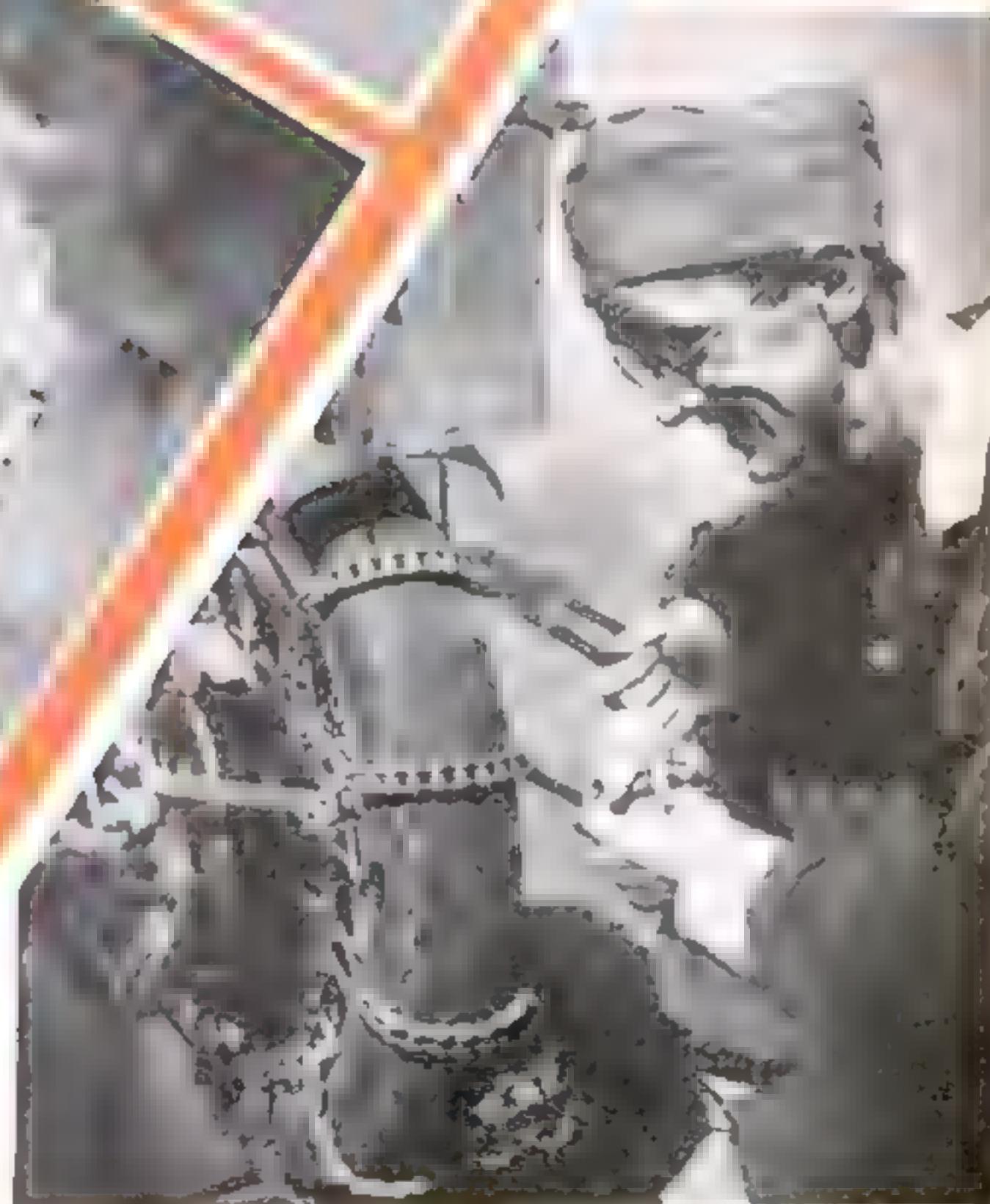
Cheats Death with Gadgets



Butler, wet sponge in mouth, ready for his fire ride



To protect his face in the glass stunt he presses it against a rubber pad



Hurtling through a fifteen-foot-long tunnel of flaming burlap saturated with oil and gasoline, Butler relies on his helmet, goggles, and a wet sponge in his mouth to protect him. Above, drive chain gives perfect traction



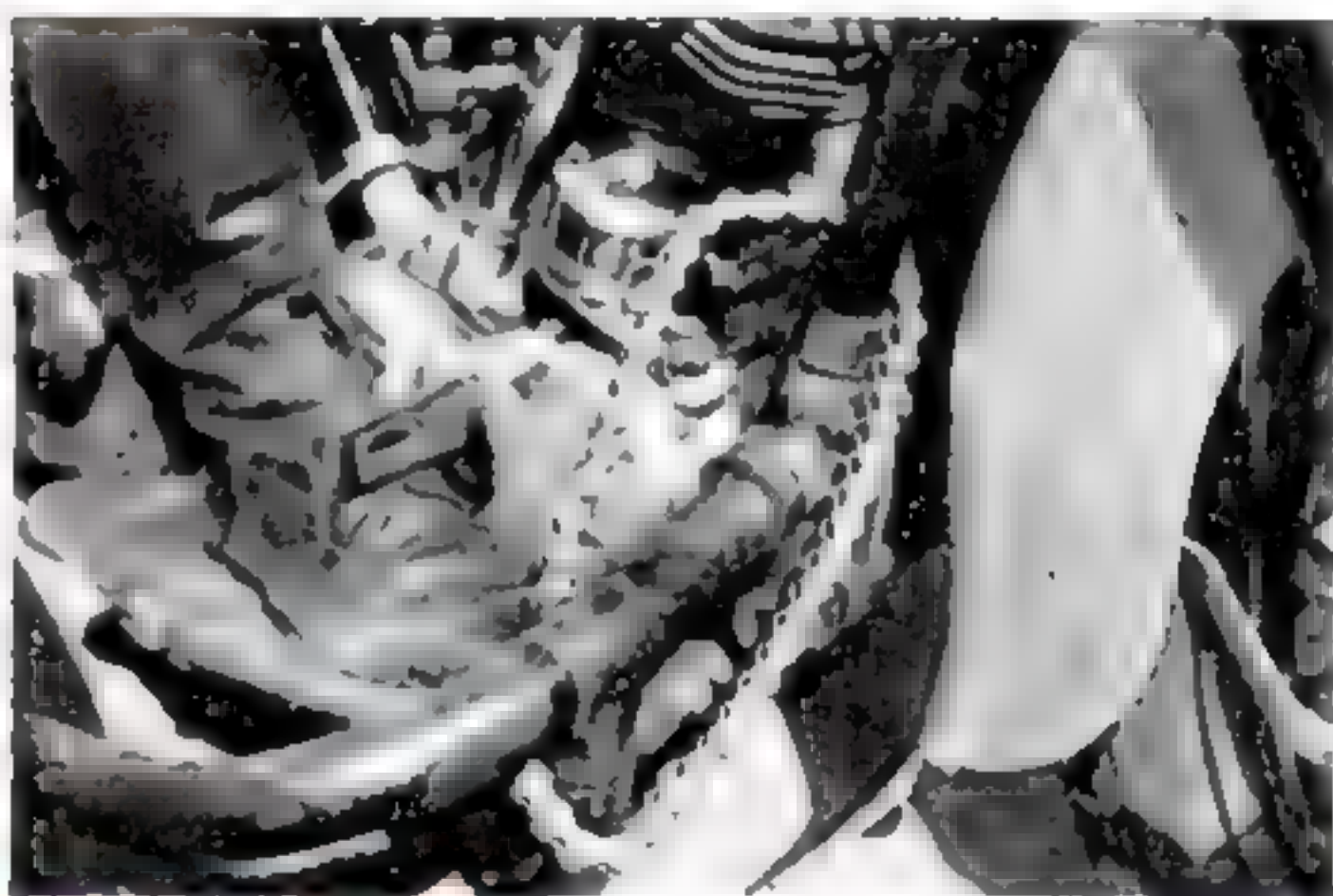
are carefully tightened to brace the handlebars.

A sponge-rubber kneeling pad, of the type used by housewives and gardeners, is fastened to the top of the rear fender. This enables the stunt man to remove the saddle post and sit far back on the machine, with his body low over the gas tank. It also gives better control for sudden stops.

Another safety measure is a pad fastened tightly to the top of the motor-cycle frame. In crash rides, Butler presses his face against this pad as a protection against flying fragments. In racing through the fire tunnel, fifteen feet long and six feet square and formed of framework covered with burlap soaked in oil and gasoline, Butler always carries a wet sponge in his mouth. It prevents him from sustaining internal burns by breathing through his mouth while he is ripping through the fifteen-foot inferno.

Protecting spectators is also a consideration in the preparations. To prevent his machine from running wild in the event of a spill, Butler has worked out an ingeniously

The business end of the dare-devil's motor cycle. Note the turnbuckles and the welded plates that reinforce the fork and handlebars for the sake of safety



For stunts with a side car attached, the car is lashed to the cycle frame with a length of drive chain—just in case!

"SOLID BOARD WALL CRASH!"

is the cryptic title of this spine-shaking stunt. Hitting it up to seventy miles an hour, the daring rider pilots his machine head-on into a solid wall of one-inch planks mounted on a framework of two-by-fours. Steel cables anchor the obstacle in place. At the first impact, the boards split. Instantly the heavy beams give way. Then, in a shower of splinters as big as baseball bats, he emerges—safe again!



simple arrangement. One end of a leather strap is tied around his left wrist; the other end is slipped between a metal spring and the handlebar. If the rider is thrown, he automatically jerks the end of the strap from under the spring and an electrical contact is made, short-circuiting the engine. With the engine dead, the machine slides to a stop without endangering spectators.



SAFETY SWITCH FOR ACCIDENTS

Should Butler be swept off his machine, the strap shown attached to his arm, above, pulls out from between contact points on the handlebars, short-circuiting the ignition and stopping the motor

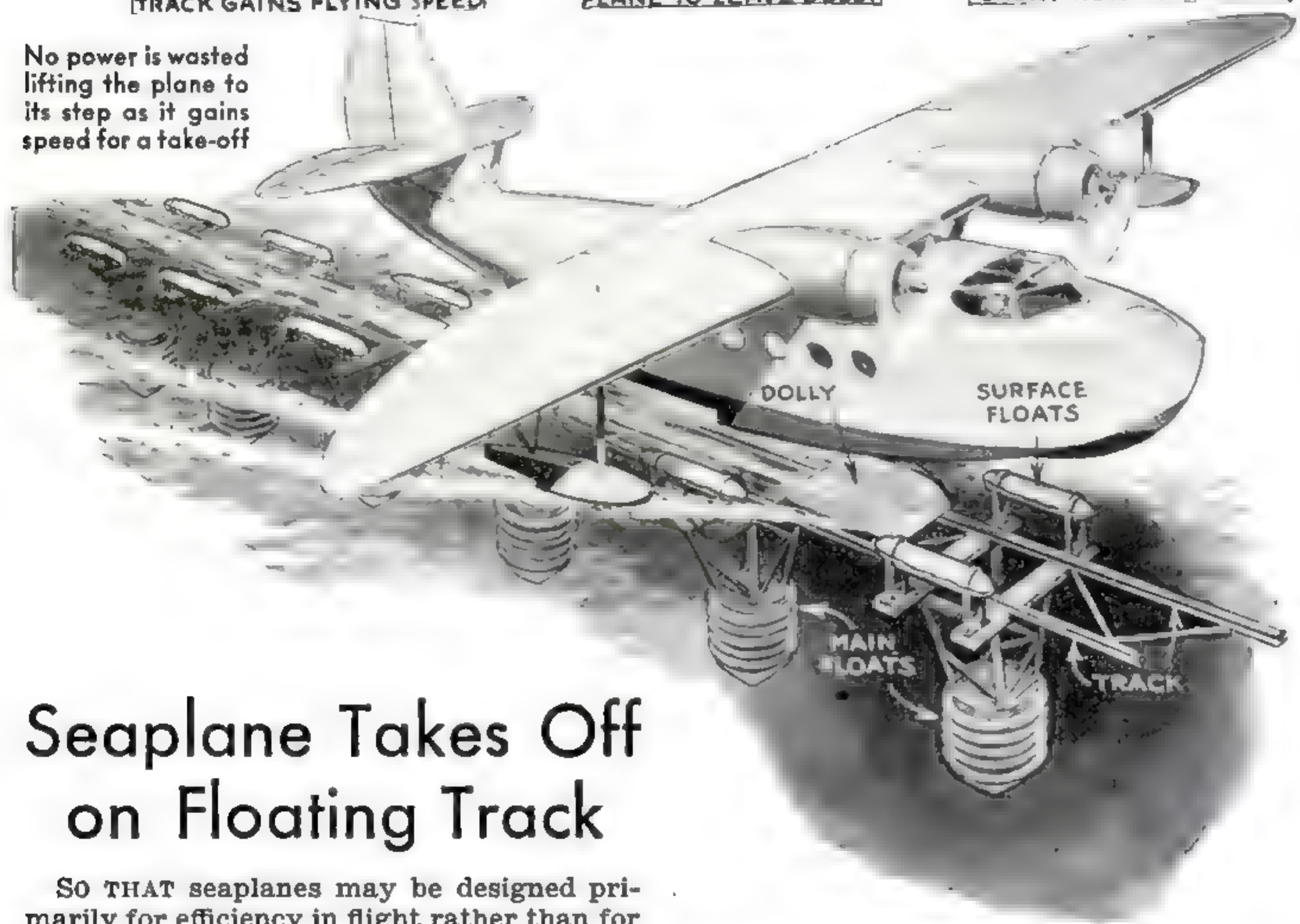


At left, ready for the worst. This is how the dare-devil rider looks as he dynamites down the stretch for a crowd-thrilling, death-defying stunt. Note the hand guards, rubber pad for his face, and the odd body angle





No power is wasted lifting the plane to its step as it gains speed for a take-off



Seaplane Takes Off on Floating Track

SO THAT seaplanes may be designed primarily for efficiency in flight rather than for overcoming the tremendous water resistance encountered while taking off, Thomas B. Rhines, of West Hartford, Conn., has devised an ingenious launching apparatus. Heretofore, more energy than was needed to maintain efficient flight was required to force a seaplane onto the planing step from which it takes off into the air. With the new

system, the ship is cradled in a dolly which runs on a steel track supported in the water by special floats. Riding on the dolly, the seaplane accelerates to a point where, when it finally slides off its carriage, it has attained sufficient forward speed to be up on its planing step ready to take to the air.



Once a minute, 1,000 reference books pass in reach of each clerk

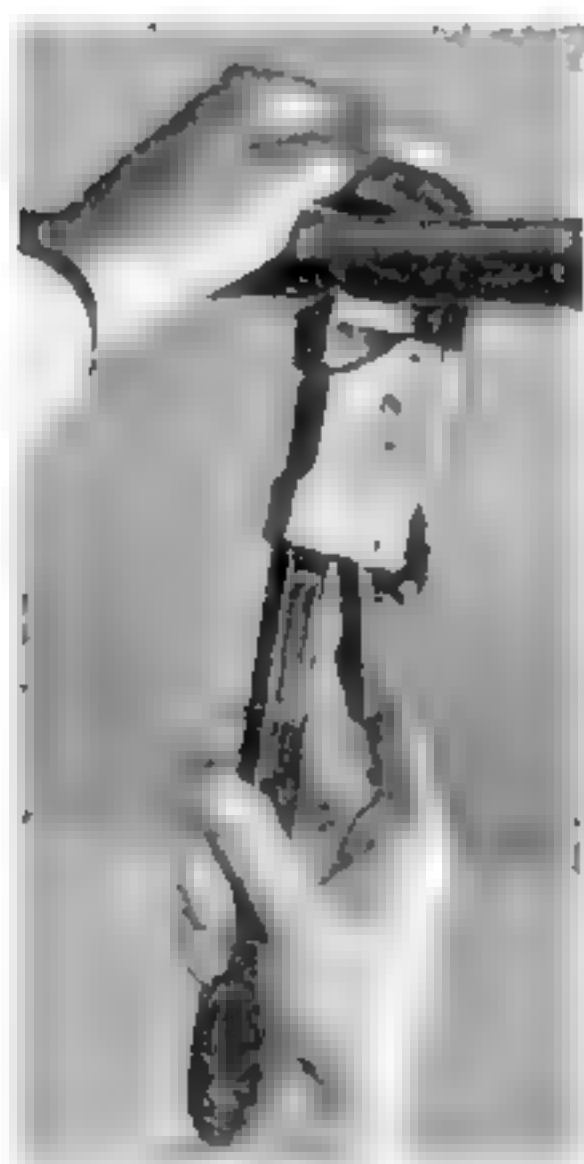
Rotating Library Aids Clerks

BECAUSE the latest telephone books and commercial directories of over 1,000 cities in 118 countries had to be easily available for quick reference, a New York publishing firm built the odd rotating library shown at the left. Shelves around its fifty-foot circumference house the reference works, and the entire unit revolves once a minute before clerks placed at desks arranged in a circle around the library's perimeter.

Swagger Stick Combines Cane with Small Purse

WOMEN who are sticklers for the latest in fashion may soon be carrying a novel swagger stick that combines a cane with a small purse. Introduced not long ago at a fashionable race track, the novel cane has a purse fastened to it just below the handle. Two race-goers are pictured in the photograph at the right leaning on their cane-purses while examining their racing cards.

Push-Button Pipe Wrench



ONE-HAND operation is made possible in a new pipe wrench which has a lever and ratchet mechanism that replaces the conventional adjustable knurled wheel. To adjust the tension on the wrench jaws, the user pumps a small finger lever, as shown at the left. The new tool is said to be adaptable to all purposes for which an ordinary pipe wrench would be used.



Note the purses attached to the two swagger sticks

Clay and Car Parts Make Up This House

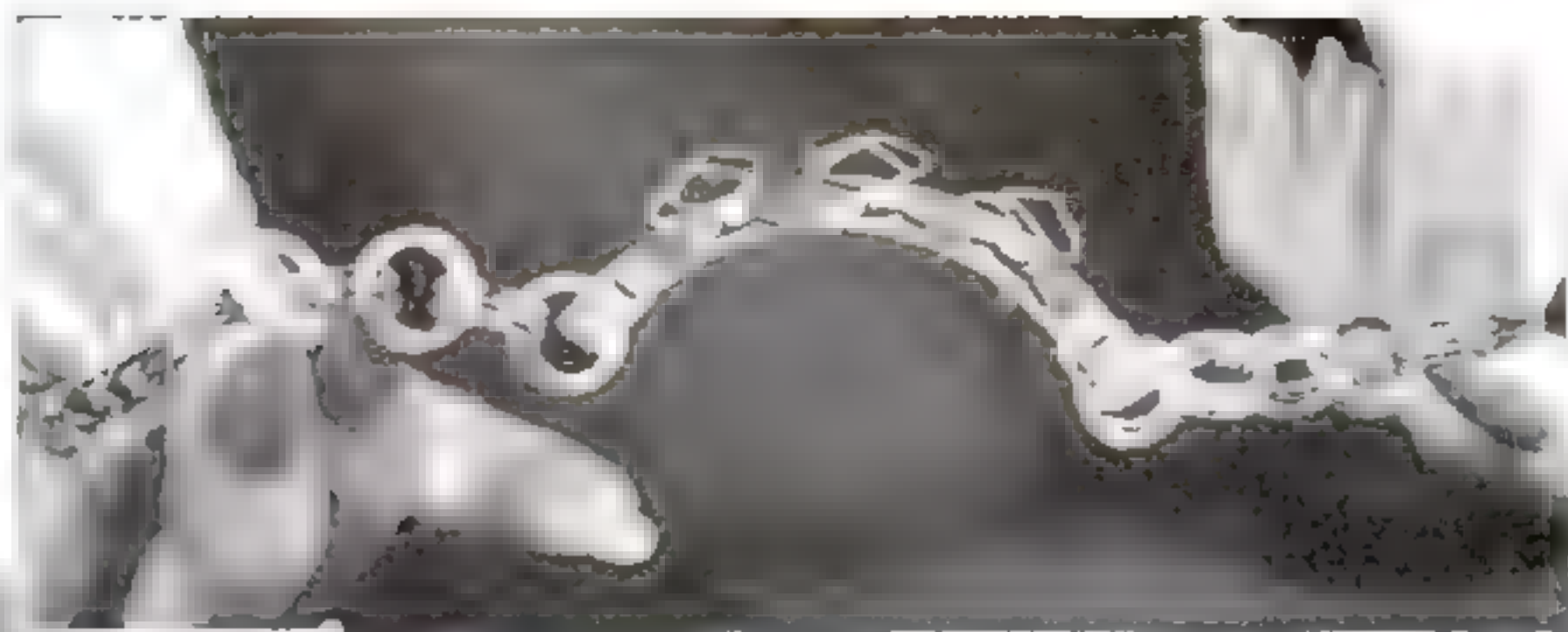


The resourceful builder (staff in hand) stands in front of his odd house

SEVERAL years ago, George Daynor, a penniless Klondike gold prospector, moved in on a Vineland, N. J., swamp used as an automobile junk yard. Daynor drained the swamp, located a freshwater brook, and, using only the materials at hand, built the curious homestead pictured at the left. Old automobile fenders form archways, discarded wagon-wheel hubs serve as decorative ornaments, and various abandoned car parts are fitted into the queer dwelling's structure. The "stucco" with which the exterior is covered is clay dug up from the swamp.



Worn on the wrist or as a necklace, the flowers are attached by means of the clamps visible in upper photo



Real Rosebud Jewelry Is New Winter Fashion

BRACELETS and necklaces made of real rosebuds are slated to be a popular winter fashion for women, according to Miss Elizabeth Day, of New York City, who invented the flower jewelry shown in the accompanying photographs. Freshly picked dwarf rosebuds are treated with a special preparation to prevent moisture evaporation, and the blooms are then fastened to a bracelet or necklace chain of light metal, fitted with tiny clasps that hold the flowers securely in place.

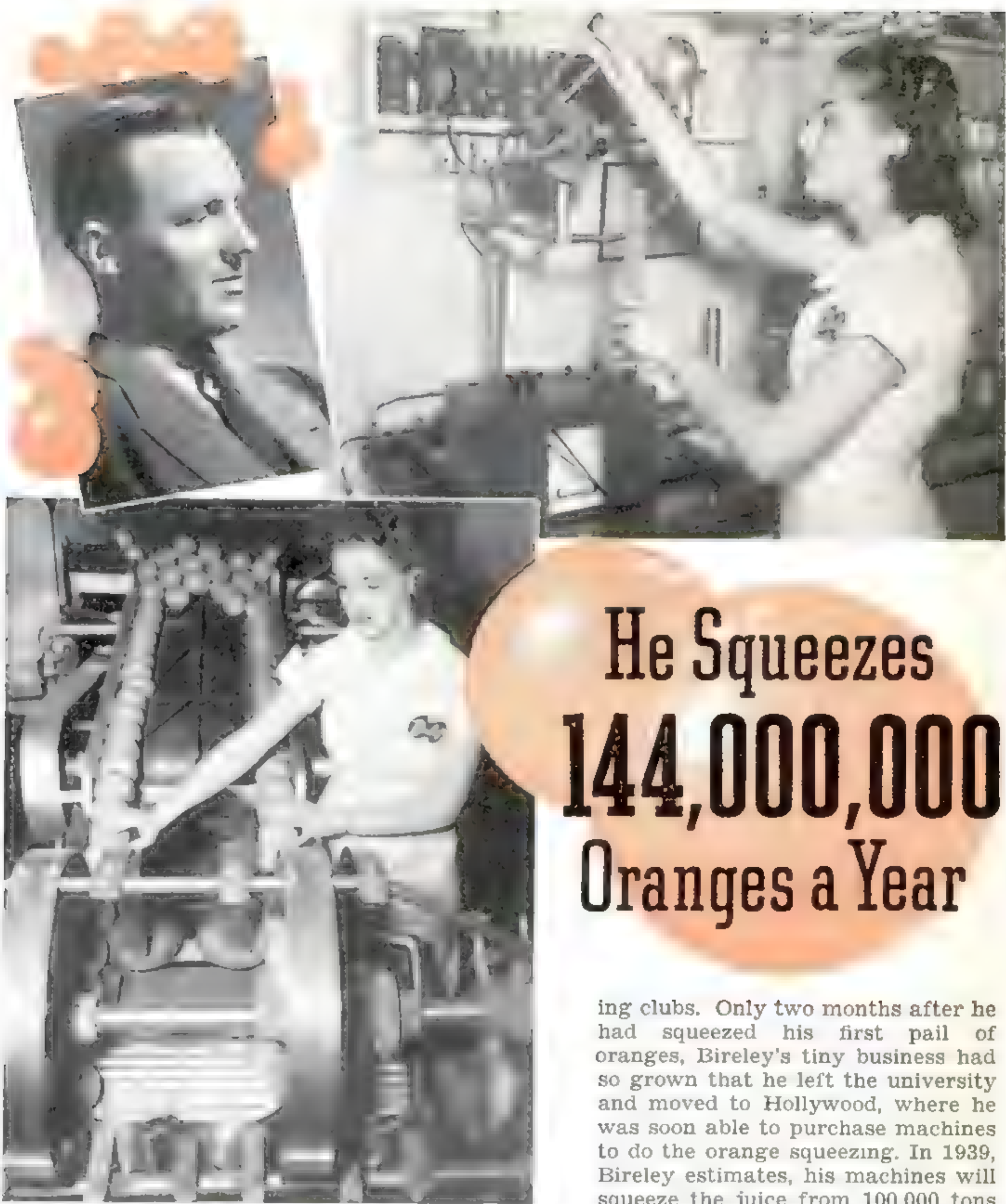
Father and Son Run Basement Business



Made of scraps of solid mahogany purchased from a furniture factory, the souvenir windmills that the Dunnewins, father and son, turn out in their basement shop bring good prices

MAKING model windmills for sale as souvenirs is the novel father-and-son business carried on in the basement workshop of Claude Dunnewin, of Central Park, Mich. The tiny mills bring a comparatively high price since they are all fashioned from small blocks of solid mahogany. The Dunnewins are able to obtain this expensive wood at a reasonable price, since the blocks are waste cuttings from near-by furniture factories, costing only forty cents for a sackful.





Frank W. Bireley, and two scenes in his orange-juice can-
nery. Above, oranges approaching the circular knives that
slice them. Upper right, a technician sampling the juice

He Squeezes 144,000,000 Oranges a Year

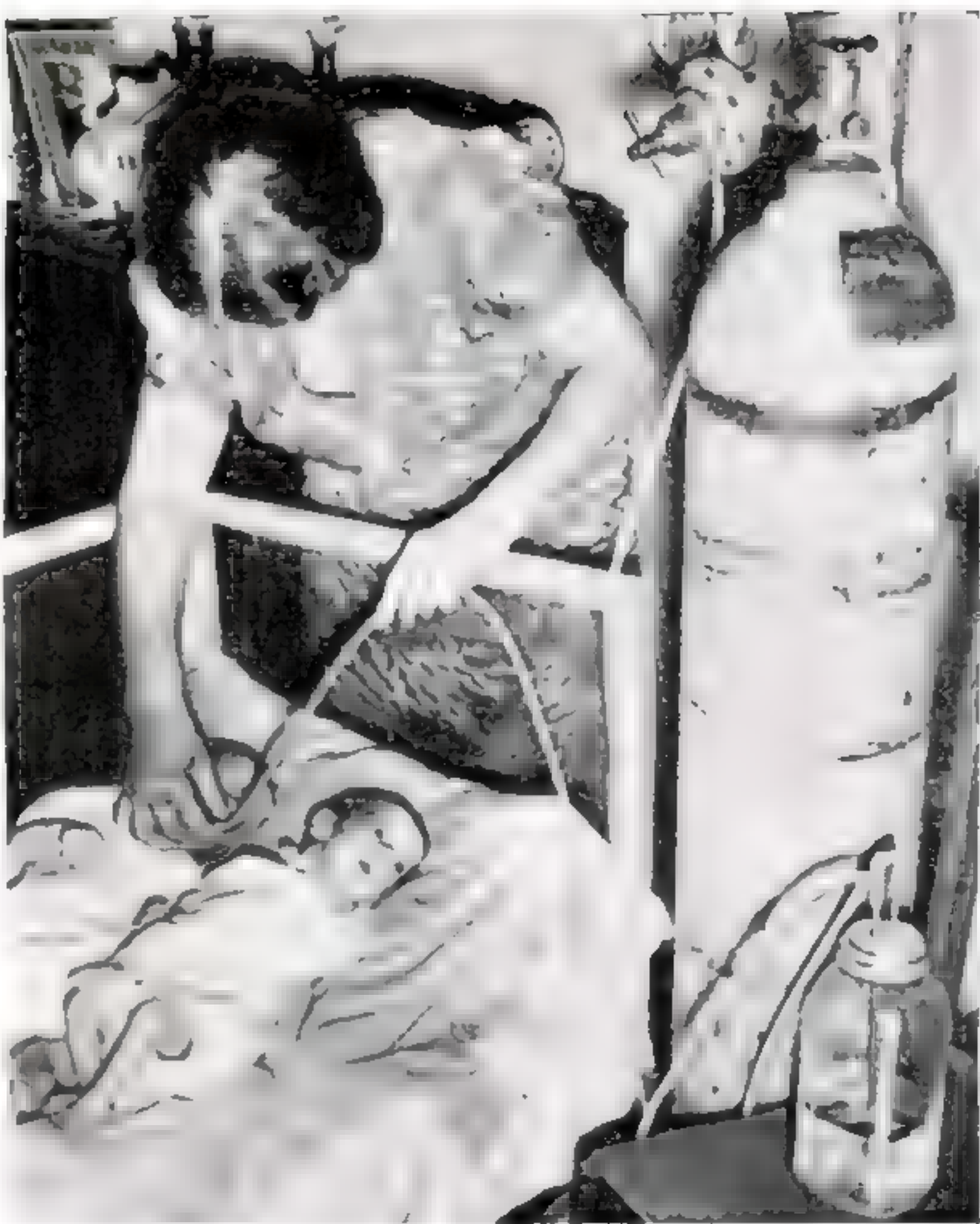
SIXTEEN years ago, Frank W. Bireley, then a poor student trying desperately to earn his way through Stanford University at Palo Alto, Calif., bought an orange squeezer and a few crocks. Before sunup, and late into the night, he sliced the golden fruit, laboriously pressed out the juice, made orangeade, and offered it for sale to restaurants, hotels, and campus eat-

ing clubs. Only two months after he had squeezed his first pail of oranges, Bireley's tiny business had so grown that he left the university and moved to Hollywood, where he was soon able to purchase machines to do the orange squeezing. In 1939, Bireley estimates, his machines will squeeze the juice from 100,000 tons of ripe oranges—more than 144,000,000—and the product will be shipped all over the world. Now every morning, instead of the sackful he once pressed by hand power, oranges by

the trainload roll up to the doors of his factory. Through a fascinating array of almost human apparatus, they are washed, sterilized, sliced by whirring, razor-sharp circular knives, and squeezed by an automatic extractor. The fresh juice is then concentrated in a vacuum machine of Bireley's own devising, pasteurized, and finally sealed hermetically in cans for shipment.

Oxygen Apparatus Is Rigged by Doctor in Emergency Case

NEAR death from the effects of whooping cough from which they had been suffering for two weeks, the four-month-old twin brothers, Charles Louie and Larry Decker Faulkner, of Idabel, Okla., recently were brought through a critical stage of their illness by the quick thinking and resourcefulness of the young country doctor attending them. Confronted with the immediate need of administering oxygen to the infants, Dr. George K. Fisher rigged up the makeshift apparatus shown at the right. The oxygen-breathing paraphernalia was made up from four lengths of rubber hose, a fruit jar of the type used for putting up home preserves, and a pressure tank filled with ordinary welders' oxygen. The nose mask was fashioned from some of the parts of the doctor's stomach pump.



How an ingenious doctor administered oxygen in an emergency

Study Films That Can't Be Seen

FILMS one molecule thick—about one ten millionth of an inch, and utterly invisible—are being studied by scientists at the General Electric Research Laboratory to discover little-understood characteristics of the tiny electrical charges existing on their surfaces. Scientists amplify the minute charges by means of an audio-frequency circuit which converts the impulses into sounds.



"Listening" for tiny currents on films one molecule thick



Clamps Let Skiers Walk Uphill

SIMPLE to install, clamps that permit skiers to walk uphill without sliding backward on the snow are now available. The units, one of which is illustrated above, stay close to the skis when coasting forward, but automatically open the instant the ski direction is reversed.

Control Room Charts Air-Raid Defense



Nerve center of London's civilian air-raid defense. Pins on map show where bombs have caused damage

LOATED "somewhere in London," the control room shown in the photograph above forms the nerve center of the British capital's civilian air-raid defense system. Twin maps, each nine feet square, hang on the

wall. With colored pins, the location of each bomb dropped on the city can be marked on one map, and at the same time field units can be dispatched to the spot to render assistance to civilians.

New Watermark Detector Aids Stamp Collectors

THREE pieces of colored glass, set in a circular plastic holder, provide the stamp collector with a new aid in detecting watermarks. The stamp is placed in a black dish, moistened with benzine, and viewed through the filters. Depending upon the color of the stamp, one of the filters will make the watermark show up clearly.

Silver Rustproofs Steel

TINY traces of silver, added to the composition of stainless steel, will do much to overcome the metal's inability to withstand the corrosive action of salt water, research scientists at the Massachusetts Institute of Technology have discovered. Addition of as little as 0.42 percent of silver chloride is said to cut down corrosion eighty percent.



Depending on the color of the stamp, one of the colored-glass filters will reveal the watermark

Operating-Room Camera Dolly

HOVERING high over the operating table in the Middlesex General Hospital, in New Brunswick, N. J., a huge one-eyed "mechanical monster," sheathed in sterile white cloth, peers down through a battery

of brilliant lights. Designed by Dr. Marshall Smith, New Brunswick surgeon, the strange apparatus is a camera dolly, built to hold a photographer directly over the operating table, so that motion pictures in full color of delicate operations may be made with a close-up viewpoint heretofore impossible to achieve. Mounted on hard-rubber casters, and constructed like a cantilever bridge, the

dolly provides an elevated saddle for the photographer, who aims his camera down on the operation through a sixteen-inch glass port-hole. Below the cameraman's seat is a basket to hold extra film, bulbs, and a complete set of tele-photo lenses. Lights that extend out on arms from the top of the dolly are controlled by a group of switches on the framework's side, while a single cable supplies electric power to prevent cluttering the operating-room floor with a maze of connecting cords. Pictures that are made possible with this apparatus are said to be amazingly clear and vivid.

Separated from doctors by the sterile cloth and glass port-hole, the cameraman on the strange dolly is in a perfect position to photograph a surgical operation



Homemade Oxygen Mask

TO SAVE himself the cost of a new oxygen mask, Art Bussy, airplane racing pilot, made his own from an automobile-battery hydrometer and a football bladder. Oxygen piped to the bladder is forced as needed into the hydrometer bulb, which is strapped to his head so that his nose sticks through a hole cut into the bulb's side.

Curb Feeler Aids Parking

L-SHAPED arms, attached to front and rear bumpers, help motorists to park close to the curb without scraping hub caps or fenders, in a device just marketed. When the tips of the arms touch the curb, electric contacts are closed, lighting a warning lamp on the dashboard. The guide rod is seen in operation at the right.



Art Bussy wearing the oxygen mask made of a hydrometer bulb and a football bladder

Players Hear Ponies Run in New Game

A PHONOGRAPH record plays a vital part in a novel horse-race game just placed on the market. Players select their horses as represented by markers on a game board.

The record is then placed on a phonograph turntable and started. A simulated radio broadcast of an actual horse race is then heard, with the name of the winning horse announced at the end. Four or five separate races are recorded on each side of the record, each on a separate groove, and there is no way of foretelling which groove the phonograph needle will follow when the record is started.



After "picking their horses" on a game board, players hear the running of the race and the announcement of the winner by phonograph



Shuffleboard Played on a Small Table



Playing shuffleboard at home. This compact, folding board can be set up in the basement or living room



Disks are propelled by spring-operated plungers

SHUFFLEBOARD, a game which commonly requires a considerable amount of space, can be played on a small table-type game board available in game and toy stores. Played by either two or four persons, the game employs sliding wooden disks which are propelled from one end of the rectangular table to the other by means of spring-operated plungers, one at each end of the board, as shown in the photograph at the left. Several different models of the table shuffleboard game, varying in size, are available.



Cutting metal pipe with a new portable oxyacetylene-torch unit. Weighing only forty-three pounds, the outfit is carried on a harness as at far right

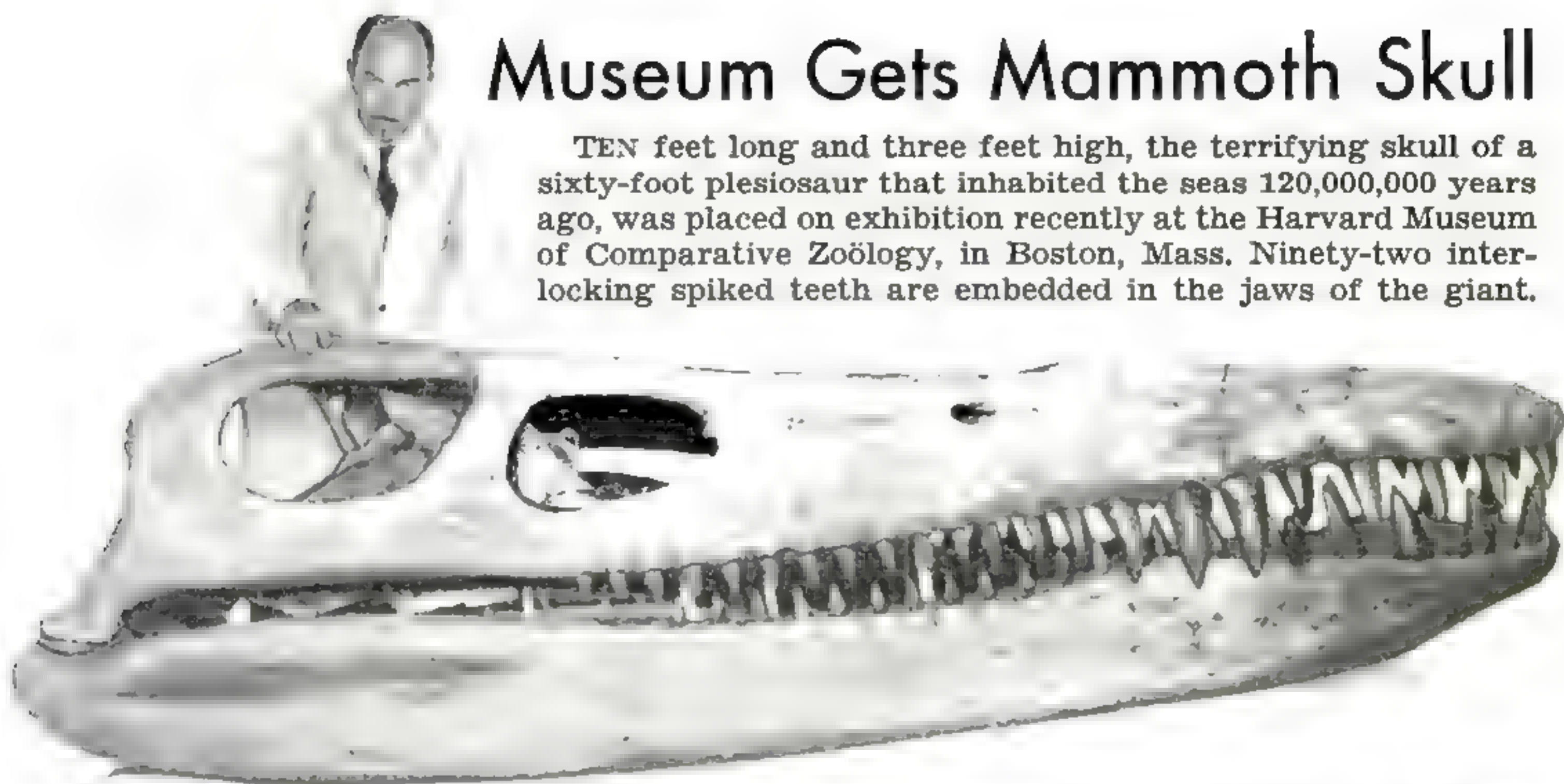
Portable Torch Aids Firemen

ESPECIALLY valuable for fire-fighters, a new portable oxyacetylene cutting torch is a self-contained unit weighing only forty-three pounds and fitted with a harness so that it can be strapped to a fireman's body over a special padded vest. The complete unit includes oxygen and acetylene gas cylinders, regulators, hose, and a cutting torch, which will operate continuously for about ten minutes.



Museum Gets Mammoth Skull

TEN feet long and three feet high, the terrifying skull of a sixty-foot plesiosaur that inhabited the seas 120,000,000 years ago, was placed on exhibition recently at the Harvard Museum of Comparative Zoölogy, in Boston, Mass. Ninety-two interlocking spiked teeth are embedded in the jaws of the giant.



Skull of a plesiosaur, the largest prehistoric sea monster whose remains have ever been found

Catapult Launches Radio Target Plane

LAUNCHED into the air by a catapult, a radio-controlled miniature plane tested recently by U. S. Army Air Corps engineers for use as a target for aerial-gunnery practice releases its own parachute and drifts back to earth when its work is done. While in the air, the midget craft is maneuvered by an officer on the ground, who controls its movements by means of a dial of the type used on telephones. When target practice is completed, he brings it over a safe landing place and presses a button on the dial panel. At once, a parachute flutters from the plane and it descends.



Radio-controlled target plane on catapult ready for launching. In flight, it is maneuvered by means of a dial, as at left. To bring it down, a button is pressed and the plane releases its parachute

Army Movies Help Train New Recruits for War

By
**ARTHUR
GRAHAME**



Mysteries of close-order infantry drill being recorded in an Army training film



Cameramen turn drillmasters to teach new recruits

FROM somewhere behind us came the high-pitched whine of the engines of fast-flying aircraft.

A few yards ahead of the army truck on whose roof we were riding, a platoon of infantry was marching briskly down the dusty road. The young officer in command turned and stared hard toward the menacing sound of the approaching planes. Then he shouted one word: "Airplane!"

The infantrymen scattered like a covey of startled quail. Some of them darted out of sight in the underbrush; others dived headlong into the roadside ditches. Now three hedge-hopping attack planes were low over our heads, knifing through the air at over 200 miles an hour with their machine guns chattering viciously. The road ahead was as deserted as a graveyard at midnight, but

as the planes roared over the place where the infantrymen had taken cover there was a burst of fire from unseen Garand automatic rifles and Colt pistols. And then, before you could light a cigarette, the planes were dim smudges in the distance.

The officer who was riding on top of the truck smiled at the man who had been cranking away industriously at a movie



Scenes like this illustrate the use of modern weapons under actual conditions met in the field

ACTION! CAMERA! OFFICERS AND ENLISTED MEN ARE ACTORS IN FILMS THAT SERVE AS DRILLMASTERS FOR RECRUITS IN PEACETIME, AND PLAY A VITAL PART IN NATIONAL DEFENSE

camera. "That should turn out to be a real good shot," he remarked. Then he turned toward the doughboys who were emerging grinning from the underbrush and ditches. "That was fine, Lieutenant," he called to their leader. "It'll be enough for this morning."

Hollywood?

No. Just the U. S. Army shooting one of the scenes of its newest motion pictures, entitled "Infantry Antiaircraft Defense."

Our army has gone into motion-picture production in a big way—but in a way very different from that followed by the Hollywood movie makers.

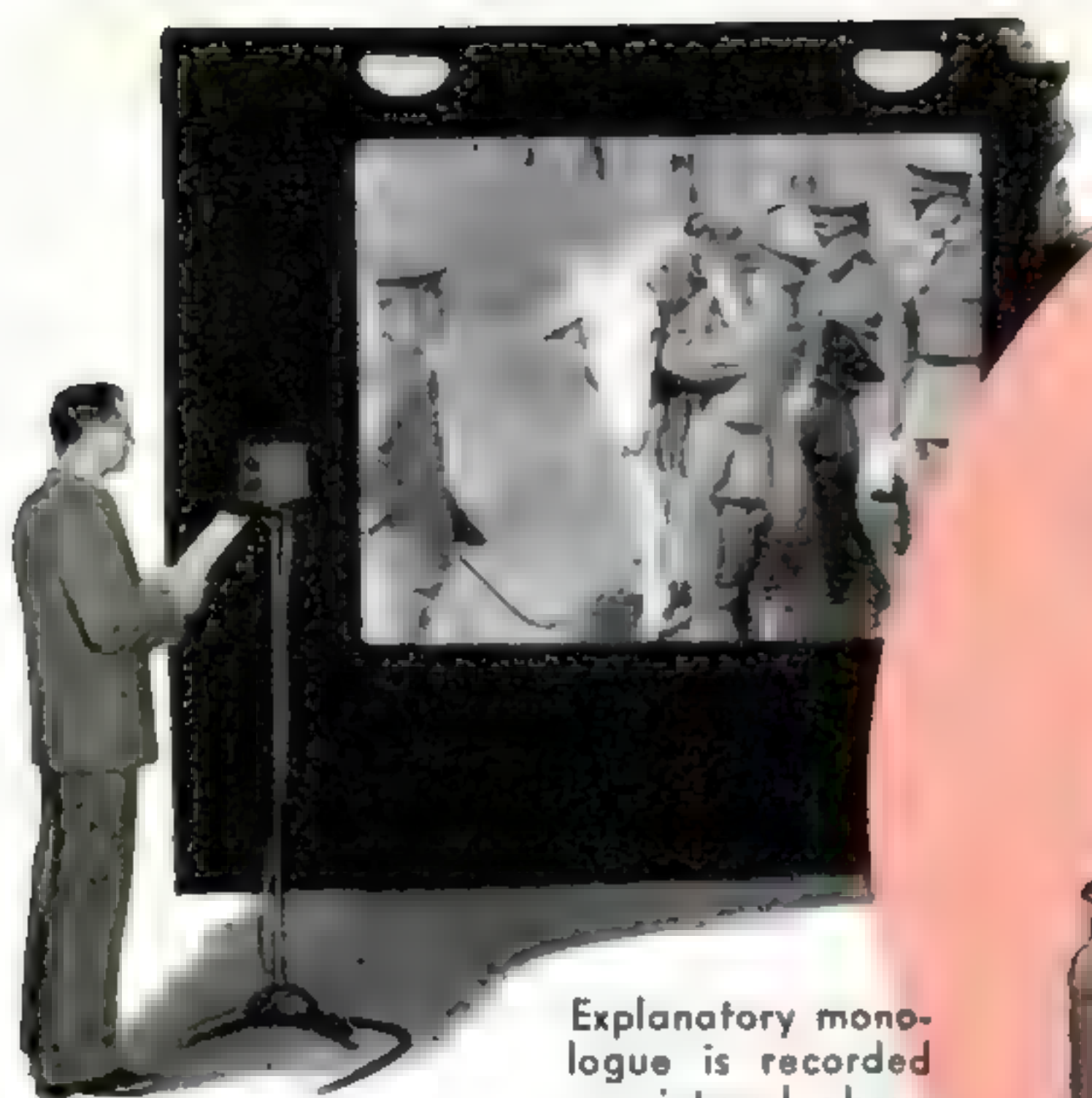
Glamour girls are conspicuous by their absence. The actors are officers and enlisted men who take a movie-making assignment as part of the day's work. Army movies

skip the romantic and play down the spectacular. Entertainment isn't their object. The Army makes them with the same purpose that it does everything else—to

increase its fighting efficiency.

Army training films were first tried out in 1917, when our small Regular Army tackled the big problem of taking a million or so of young men out of civil life and turning them into soldiers in a hurry. Many World War recruits mastered the intricacies of close-order infantry drill with the aid of a crude silent movie titled "School of the Squad." Before the end of the World War, a few other films were made, covering some of the fundamentals of soldiering, and played an important part in the military education of thousands.

Training films had proved their value, and the Army decided to go ahead making them—for current use, and, more important, for the purpose of building up a graphic, up-to-the-minute library on the



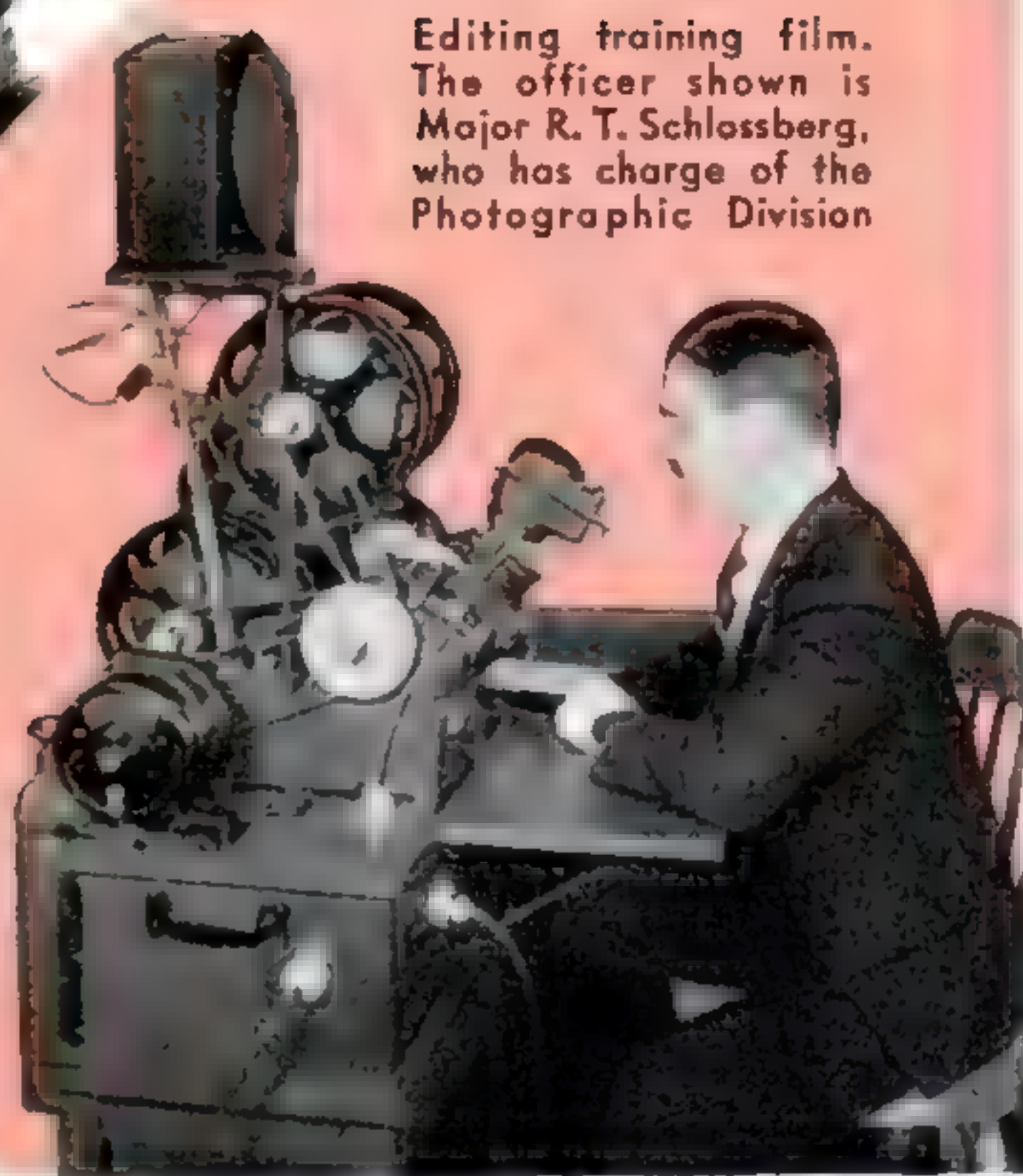
Explanatory monologue is recorded as pictured above

science of modern warfare which in time of need would provide a quick, standardized and always-ready system of making soldiers out of raw recruits as quickly as possible to meet any requirement for defense.

Early in the game the officers in charge of the making of training films realized that if their productions were to be of real value they would have to be the technical equals of the output of the Hollywood studios. Knowing that pictures of the necessary high quality could be made only under skilled direction, the Army began sending officers to school in Hollywood to learn the movie-making trade. There they are given a year of practical experience in all the phases of motion-picture production, and are let in on some of the most closely guarded trade secrets of the big producers.

Nearly all of the training films are "shot" at the various service schools, such as the Infantry School at Fort Benning, Ga., and the Cavalry School at Fort Leavenworth, Kans. Two field units, one based at Fort Monmouth in New Jersey and the other at Wright Field in Ohio, are kept busy with this part of the work. But the headquarters of the Army's movie-making industry is the Signal Corps Photographic Laboratory at Fort Humphreys, in Washington, D. C. There, with the aid of the most modern equipment, the film is developed, edited, and printed by a staff of highly trained technicians, some military and some civilian, working under the general direction of Major R. T. Schlossberg, the officer in command of the Photographic Division.

Up to date forty-two training films have been produced. Their subjects range all the way from what to do if you are unlucky



Editing training film. The officer shown is Major R. T. Schlossberg, who has charge of the Photographic Division

enough to get wounded, to the throwing up of hasty field fortifications and the tactical employment of artillery. Production has been speeded up recently, and the schedule for the current fiscal year calls for the making of forty-three 1,000-foot reels. Among the subjects are the use of anti-aircraft machine guns, the control of venereal diseases, and the extensive meteorological work that is done by the Army. Much of this year's increased production will be for the greatly expanded Air Corps.

Sound has been used in one way or another in all of the training films which have been produced since 1932. Usually it is in the form of an explanatory monologue accompanying the action. The Army movie makers use all the tricks of the Hollywood trade to emphasize important points. The telephoto lens brings distant happenings close up on the screen. Slow motion gives detailed instruction when it is necessary. Animated drawings make essential points clear. In a few of the pictures, cameras operated by remote control have been used to take the students into spots too dangerous for even a dare-devil movie cameraman. Sound amplification makes it possible to listen in on telephone conversations and to hear whispered commands.

In the training films as little as possible is left to the imagination, and no essential action ever is left out. In the film on hasty field fortifications, for example, as much emphasis is placed on the correct way to grip an entrenching tool as on the advance

of a skirmish line under fire. When desirable the picture can be stopped and parts of it run over and over again until the students thoroughly understand the points involved. Lengthy subjects are covered in separate 1,000-foot reels, breaking the instruction up into fifteen or twenty-minute lessons which are not too severe a tax on the attention.

Training films are made in both the standard thirty-five-millimeter and the sixteen-millimeter sizes, and are distributed to Army posts by the signal officers of the nine corps areas and four foreign departments. Nearly all Regular Army units, and many National Guard outfits, are equipped with thirty-five-millimeter projectors. The sixteen-millimeter films are used mostly for the instruction of Reserve Officers' Training Corps students in colleges, and of Reserve officers.

While the training films are being exhibi-

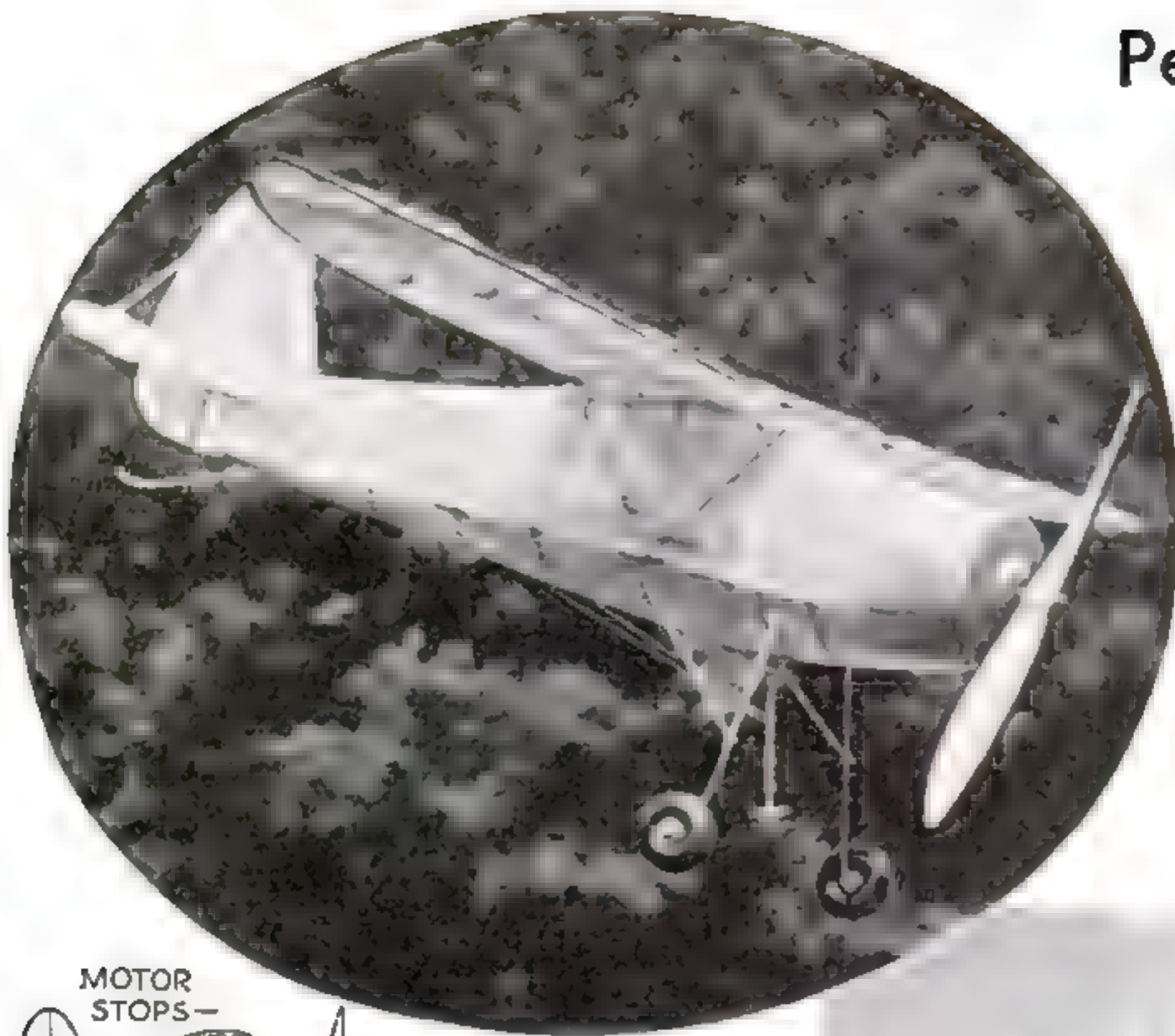
ted constantly as a part of the Army's regular training program, their greatest value lies in their availability as a standardized method of training recruits quickly. In modern war, days saved mean both lives and dollars saved to the country.



Making a movie to show use of machine guns in antiaircraft defense

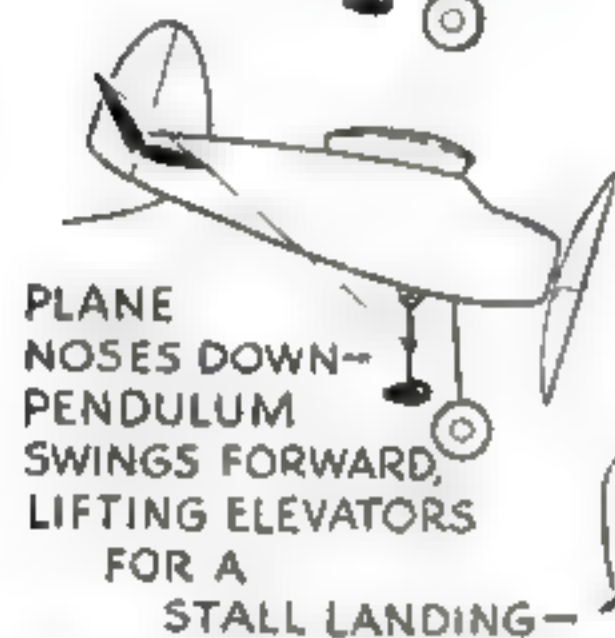
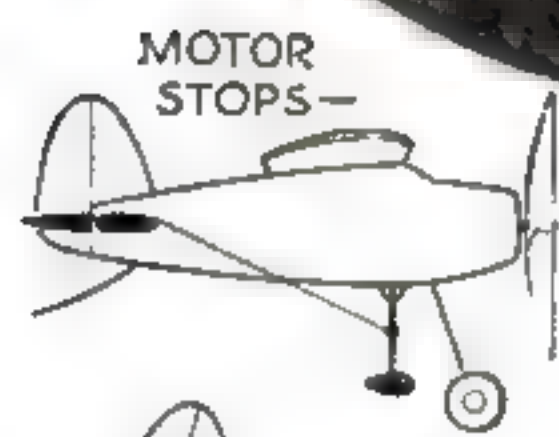


Army cameramen shooting low-flying "enemy" planes as infantrymen take cover off the road

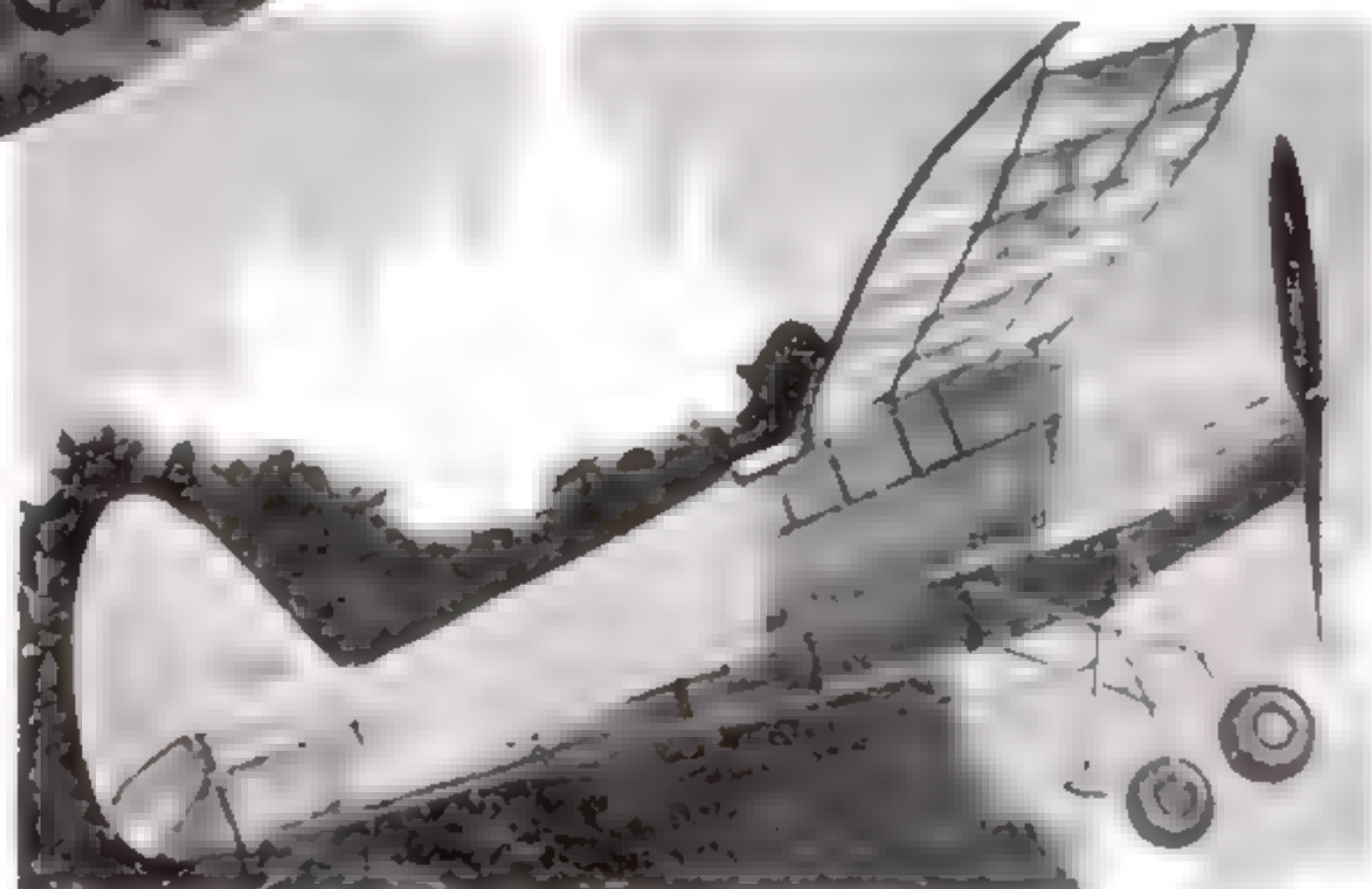
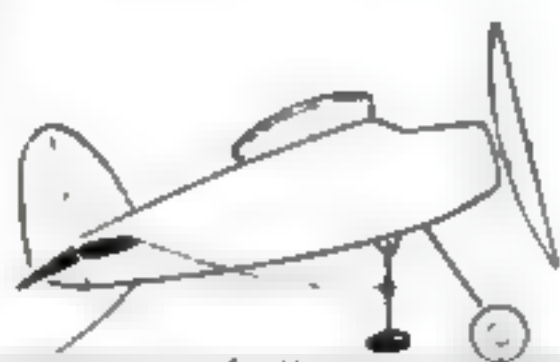


Pendulum Stabilizer for Model Plane

ANNOYED by frequent crack-ups that practically demolished his model airplane every time it went into a dive, Ed Carstens, of Warrensburg, N. Y., developed a novel pendulum stabilizing device. When the ship starts to dive, a pendulum hanging down from the fuselage swings forward, operating control lines that automatically adjust the elevators to bring the craft down safely.



How the pendulum stabilizer works to pull the model plane quickly out of a dive, saving it from making a disastrous crash



The model plane in flight in two positions. The pendulum swings right into action whenever the nose dips

Pocket Gauge Measures Speed of Wind



Compact wind indicator in use. Besides registering wind velocity on the dial seen in close-up at right, it also shows the direction of the wind and contains a built-in compass

ESPECIALLY useful for yachtsmen, hunters, golfers, amateur plane pilots, and other sportsmen, as well as forest rangers and meteorologists, a low-cost wind indicator now on the market is small enough to be tucked into a vest pocket. Built of materials that are non-

magnetic and rustproof, the instrument is made with a dial face calibrated at five-mile intervals up to thirty miles an hour, or at ten-mile intervals up to sixty miles an hour. Weighing less than two ounces, including its plastic case and cover, the device has a bottom section that may be used as a water-tight compartment for money or matches. It is less than four inches high.





Odd Ice Bike Puts Hockey on Wheels

"BICYCLE HOCKEY," in which players are mounted on special bikes equipped with runners instead of on skates, was foreshadowed as a new sport possibility by a recent exhibition at a rink in Brighton,

England. Freddie Chapman, riding a curious "ice bike" of his own design, whizzed about the rink wielding a hockey stick in competition with another player mounted on skates in the conventional manner.

Cot Folds into Small Bundle

FOLDING up into a flat and compact bundle, hardly larger than a brief case, a new collapsible cot is equipped with a handle for transporting it as a piece of luggage. Opened out, the cot provides a hammock-type bed, seventy-three inches long and twenty-seven inches wide. The folding bed is formed of tubular steel and canvas and is said to be swayproof. Its total weight is fifteen pounds.



Weighing only fifteen pounds, this cot folds compactly for carrying as at left

Old Game Resembles Baseball and Golf



The batsman swings his ten-foot mallet at . . .



a puck set in clay on a ramplike tee

SWINGING a ten-foot mallet with a combination golf and baseball stroke, the batsman pictured at the top of the page smashes a puck 300 yards down a fairway in the game of hornuss, one of the most ancient sports known, now enjoying a revival of popularity in Switzerland. Fielders wielding "schindels" that resemble oversize bakers' shovels try to stop the puck before it lands.



Catchers try to stop the flying puck by holding up their odd "schindels," or throwing them aloft



Camouflage Hides Power-Plant Towers

HUGE cooling towers that form a part of an electric generating plant at Freeman's Meadow, near Leicester, England, have been ingeniously camouflaged recently as a protection against the bombing planes of raiding enemy air fleets. Painted like stage scenery, or a mammoth Hollywood

outdoor movie set, the vase-shaped cooling towers have a strange and fantastic appearance when viewed close-up, as in the photograph reproduced above, but seen from a distance, it is said, the group is exceptionally hard to identify as the towers of a power plant.

Barber's Hair Collector Uses Suction Collar

A HAIR-CATCHING suction collar, designed for barber-shop use by Morris Hartzman, of Dubuque, Iowa, collects hair as it falls from a barber's scissors, sucks it down through a pipe and dumps it in a collection bag similar to that used in a vacuum cleaner. As shown in the drawing at the right, the device is attached to the back of the barber-shop chair so that it fits snugly around the neck of a customer. As his hair is snipped off, it drops into the collar's trough. A suction fan draws the loose hair from the trough down the hair-collecting hose. The inventor plans that all chairs in a barber shop will be so equipped, hoses from each chair being connected to one larger pipe line that ends in a single hair-collecting bag large enough to serve the entire barber shop. Hair would thus be kept from littering the floor.



Hair falls into the collar-shaped tray, and is sucked through a hose into the collecting bag

FIGHTING FOREST FIRES

WITH BOMBS FROM THE AIR



Discussing strategy for fighting an imaginary fire, Gordon Ingraham, Forestry Service pilot, and associates study a map of the area. The plan calls for "bombing" trees and bushes with the fireproofing liquid put in the plane above

FIREPROOFING foliage with chemical bombs dropped from the sky is the dramatic new method of fighting forest fires recently tried out in California. Wheeling over the San Bernardino mountains a few weeks ago, Gordon Ingraham, U. S. Forestry Service pilot, demonstrated how the plan will work.

Above a white target representing an imaginary fire, Ingraham jerked a trip-lever beside the cockpit of his monoplane. Hatches dropped open beneath the fuselage. Seven glistening five-gallon cans of mono-ammonium phosphate, a chemical solution which fireproofs leaves and twigs, plunged downward, bursting as they struck the earth. Each showered the trees and bushes around it with the flame-resisting fluid.

In a real emergency, as many as sixty cans, holding a total of 300 gallons of chemicals, can be carried by three-mile-a-minute Forestry Service planes. These swift machines would arrive a few minutes after the first alarm came in from lookout towers in the forest. In fighting fires of this type the time factor is of the utmost importance.

Patrol planes can also be equipped with the necessary hatches for dumping chemical bombs. Then, if a flying ranger sights smoke in the woods below, he can dive and encircle the incipient fire with a curtain of chemically covered leaves and twigs.

Mono-ammonium phosphate is harmless to vegetation and animals. In the forest it will form a temporary "fire wall" to hem in a starting blaze, keeping it from spreading until the ground crews can swing into action. Throughout such a flight, the bombing pilot will be in constant, two-way communication with forest rangers on the ground, who can inform him of prevailing wind conditions.



AERIAL WAR ON FLAMING PERIL

By pulling a lever, the pilot opens hatches in the fuselage. Cans of liquid hurtle earthward, burst, and spray a fireproof coating over the foliage



LIKE AN ARTILLERY OBSERVER, this spotter equipped with a two-way radio posts the pilot on wind direction and speed, and bombing accuracy

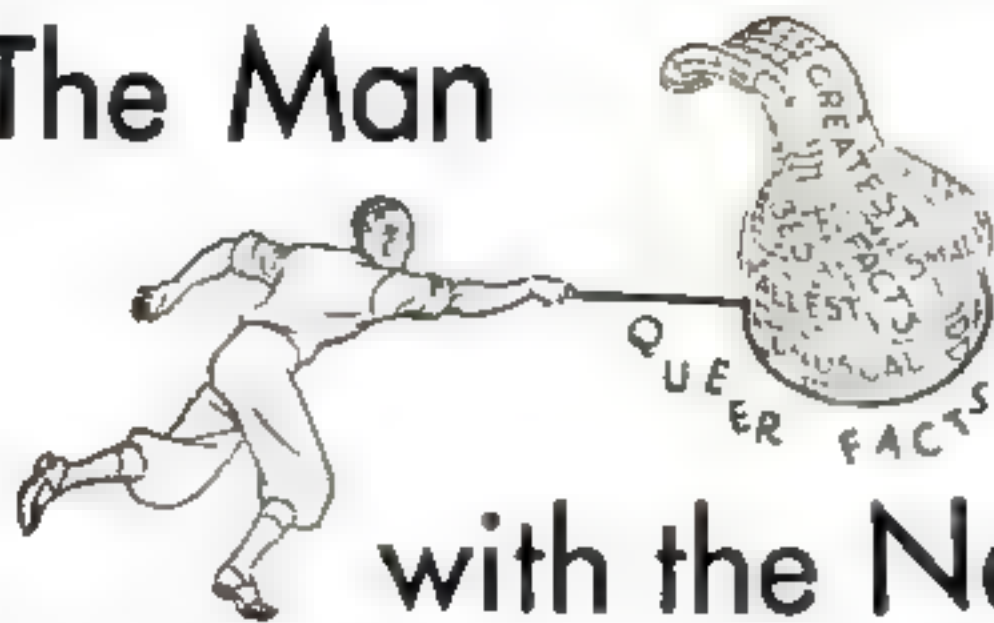


Fast "Mosquito Boats" Aid British Navy

TORPEDOES plunging ahead past her knifelike bow, the high-speed motor torpedo boat shown racing through the waters of the English Channel in the photograph above is an important fighting unit of the British Navy. Tremendously fast, the craft is designed to rely on her speed and maneuverability to offset her lack of armor. In actual use, the streamline torpedo carrier races down on her prey, zigzagging

through the water at top speed to make herself as difficult a target as possible. Once close to an enemy ship, the torpedo boat heads straight for it, launches her deadly load of torpedoes, and then veers quickly aside for a fast trip back to her base. This photograph, passed by the British censor, is said to be the first ever taken of one of these craft actually launching its torpedoes while running at full speed.

The Man



with the Net

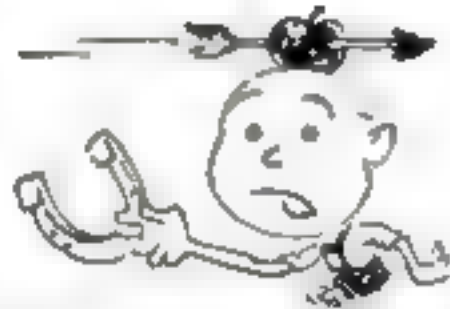
AUTHORITIES estimate that 5,000 different languages are spoken in the world.

RIVET HEADS on the outside of a big airplane produce enough resistance at top speeds to require 180 additional horsepower on the plane.

GEESE were the first domesticated birds.

HORSESHOES 1,500 years old have been found in Switzerland.

YOU'RE
TELLIN'
ME!



REMOVING chewing gum from floors and carpets at a New York department store keeps one employee busy all night long.

DRIED APPLES must contain no more than twenty-four percent water, according to the law.

CHRISTOPHER COLUMBUS discovered the Sargasso Sea.

OWLS lay eggs as round as billiard balls.



DON'T TRY TO
PLAY 'EM!

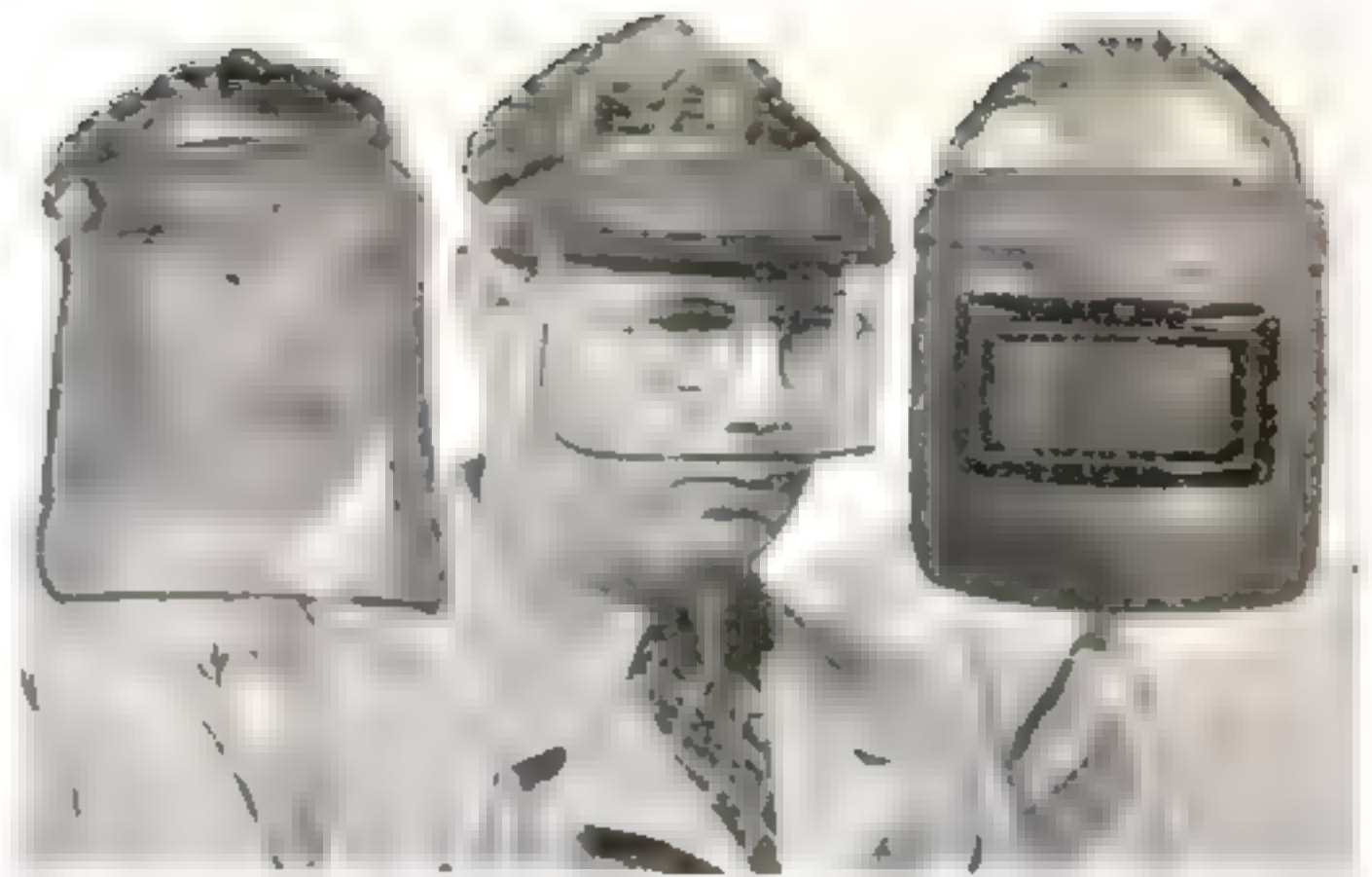
IN INDIA, 290,000,000 persons out of a population of 350,000,000 go barefoot.

GREASE from fireflies is used in the Orient to give rigidity to bent bamboo.

HUMAN TONGUES perceive sweets quickest, salty things second, sour things third, and bitter tastes last of all.

TWENTY-EIGHT THOUSAND gallons of water will evaporate from one oak tree during summer months.

IF IT GETS
THE WATER!



Three Face Masks in One

A "TRIPLE-THREAT" mask, with interchangeable parts, has just been placed on the market for workmen. Fitted with a wire-screen shield, it is used in babbitting; with a transparent-plastic window, it is suitable for buffing and polishing; with a shielded glass window, it guards a welder.

Car Sponge Fits the Hand

DEvised as an aid for cleaning automobiles, a new sponge is shaped to fit the hand and is chemically treated to remove dirt and grime. In addition, there is a pocket in the sponge in which a cake of soap can be placed.



Collars Test Crickets

PAPER collars, that kept crickets from eating after they had been sprayed with poison in a Montana laboratory, recently helped determine that sprays are as effective as poisoned grain for killing them.



One of the crickets used in the poison-spray test

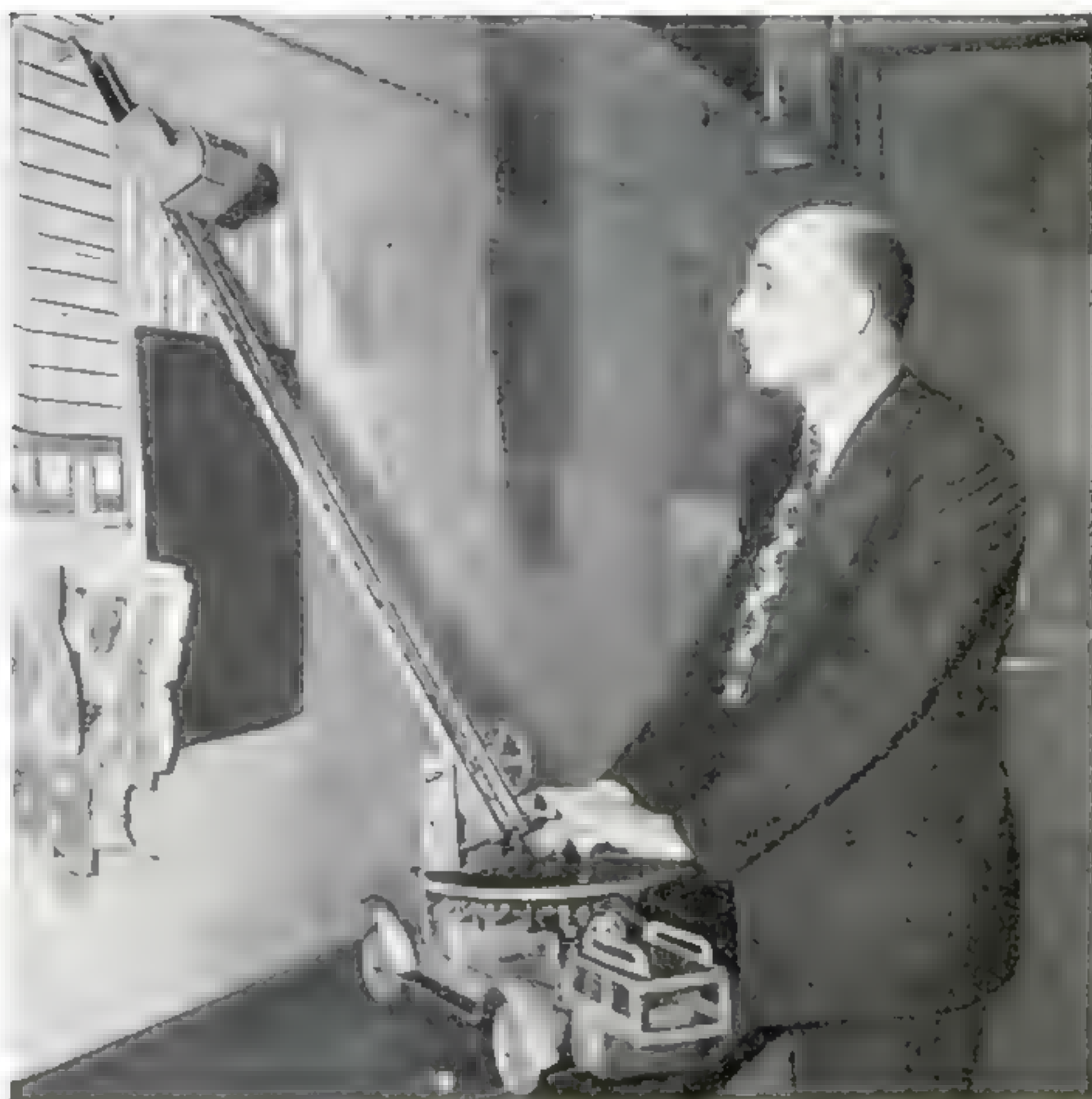
If Tombstones Told the Truth

By
**BERTON
BRALEY**



Elevator Speeds Fire-Ladder Rescues

QUICKER rescue of persons trapped by flames in the upper stories of burning buildings is the purpose of a life-saving elevator for fire departments, developed by Morris Honig, of New York City. In the illustration at the right, Honig is shown with a model of his device staging a theoretical rescue at the window of a tall building. Designed to be attached on runners to the extension ladder of a fire truck, the elevator car is drawn speedily up the ladder by means of ropes and pulleys. When it reaches the window where it fits snugly into the casing, the trapped occupants of the building simply step into it and are quickly lowered to safety. When the car reaches the truck, the rescued persons walk down steps to the ground.



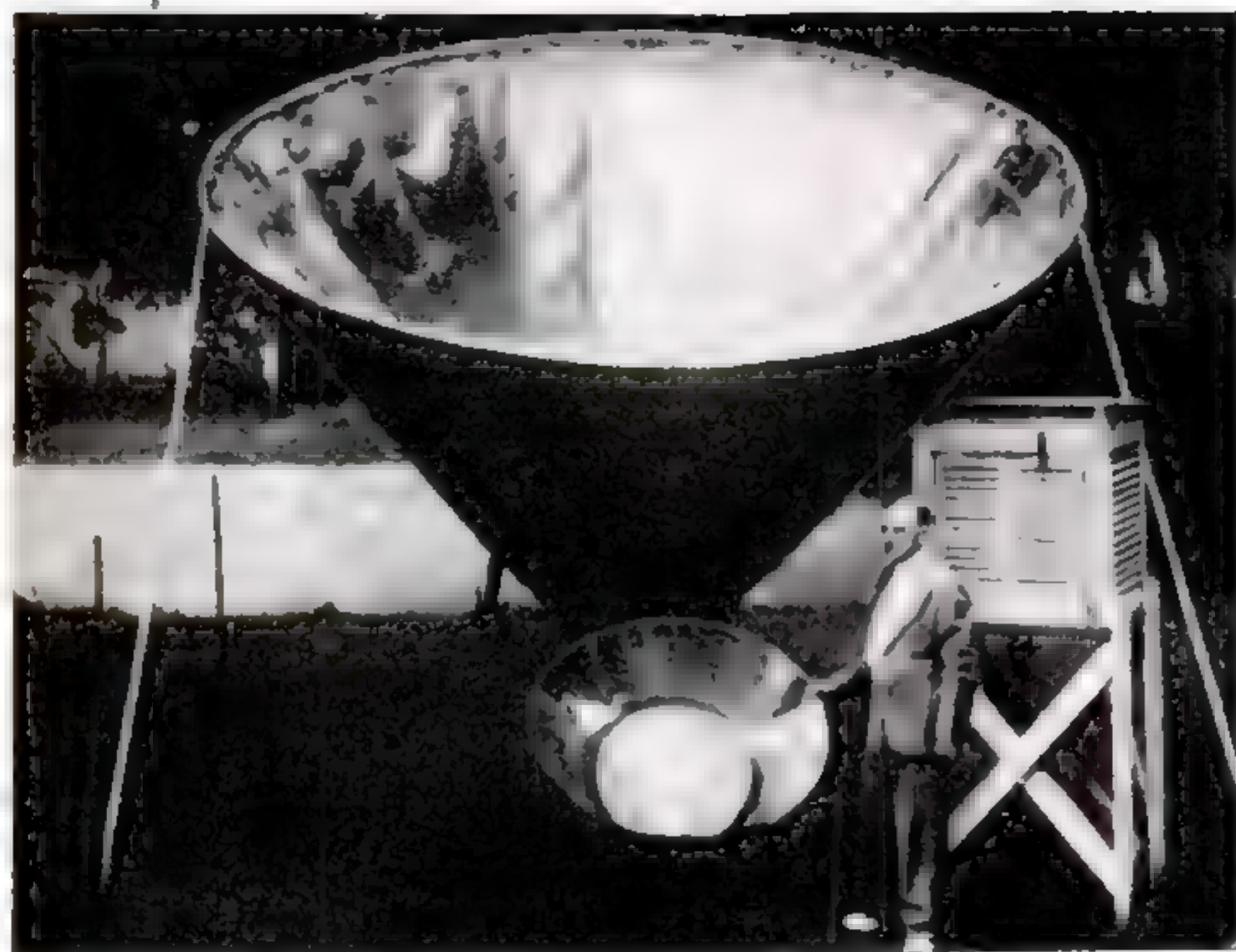
How the rescue car travels up a ladder to the window of a building



Autographs of more than 600 screen actors adorn the car

Autographed Auto Tours Country To Get Signatures

AUTOGRAPHS of more than 600 Hollywood personalities, that will never be pasted in an autograph collector's album, adorned the entire surface of an automobile in which Miss Louise Rose, representing the Motion Picture Producers Association, completed a transcontinental tour a short time ago. Starting out with almost a "carful" of autographs, Miss Rose gathered additional signatures of stage and screen celebrities en route, winding up her trip in New York City where, in the picture at the left, Miss Collette Lyons, of the cast of a musical comedy, is shown adding her name to the others. The tour was made as part of a campaign undertaken by the Producers Association to discourage parents from taking children to the film city in the hope of landing jobs.



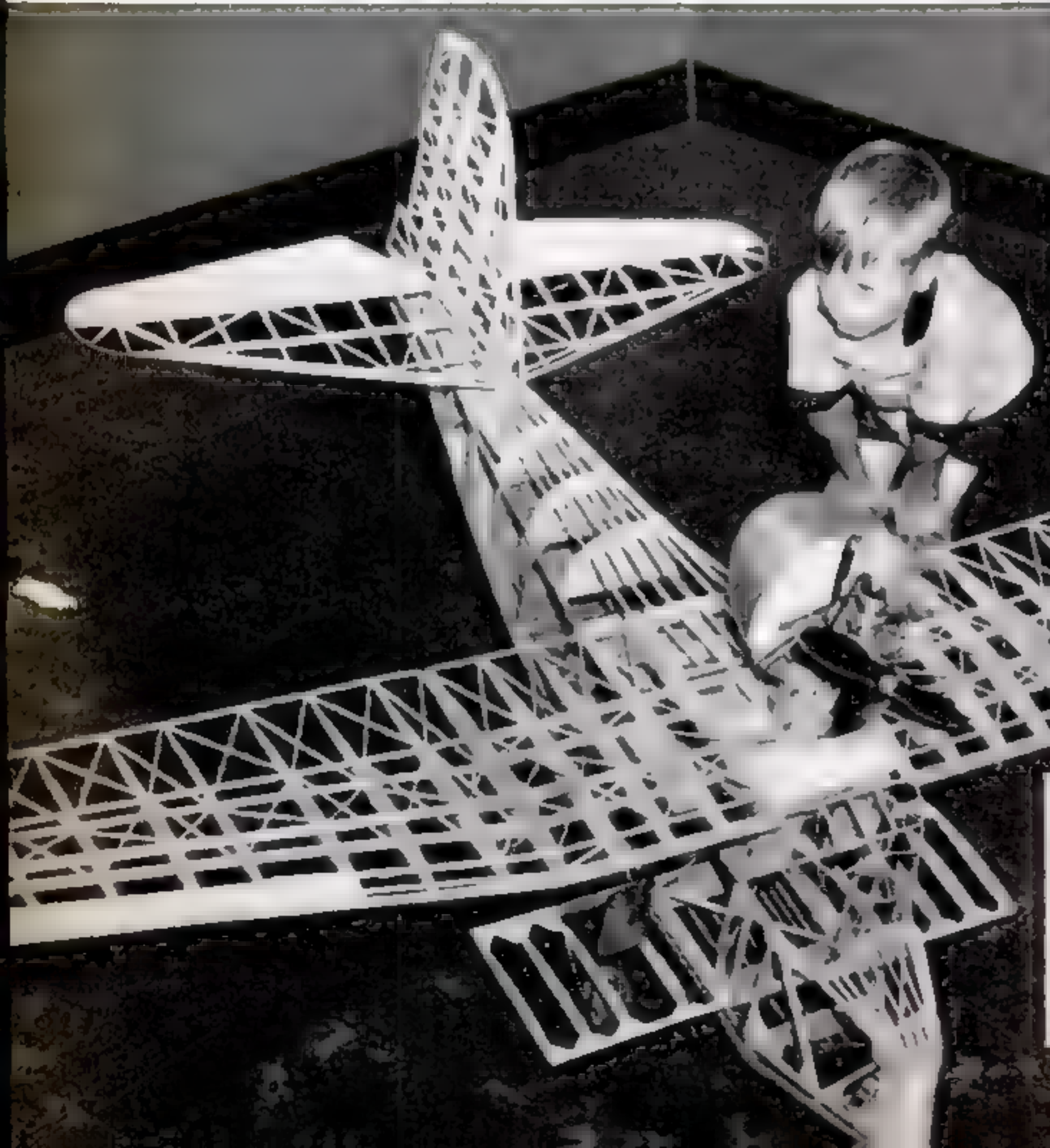
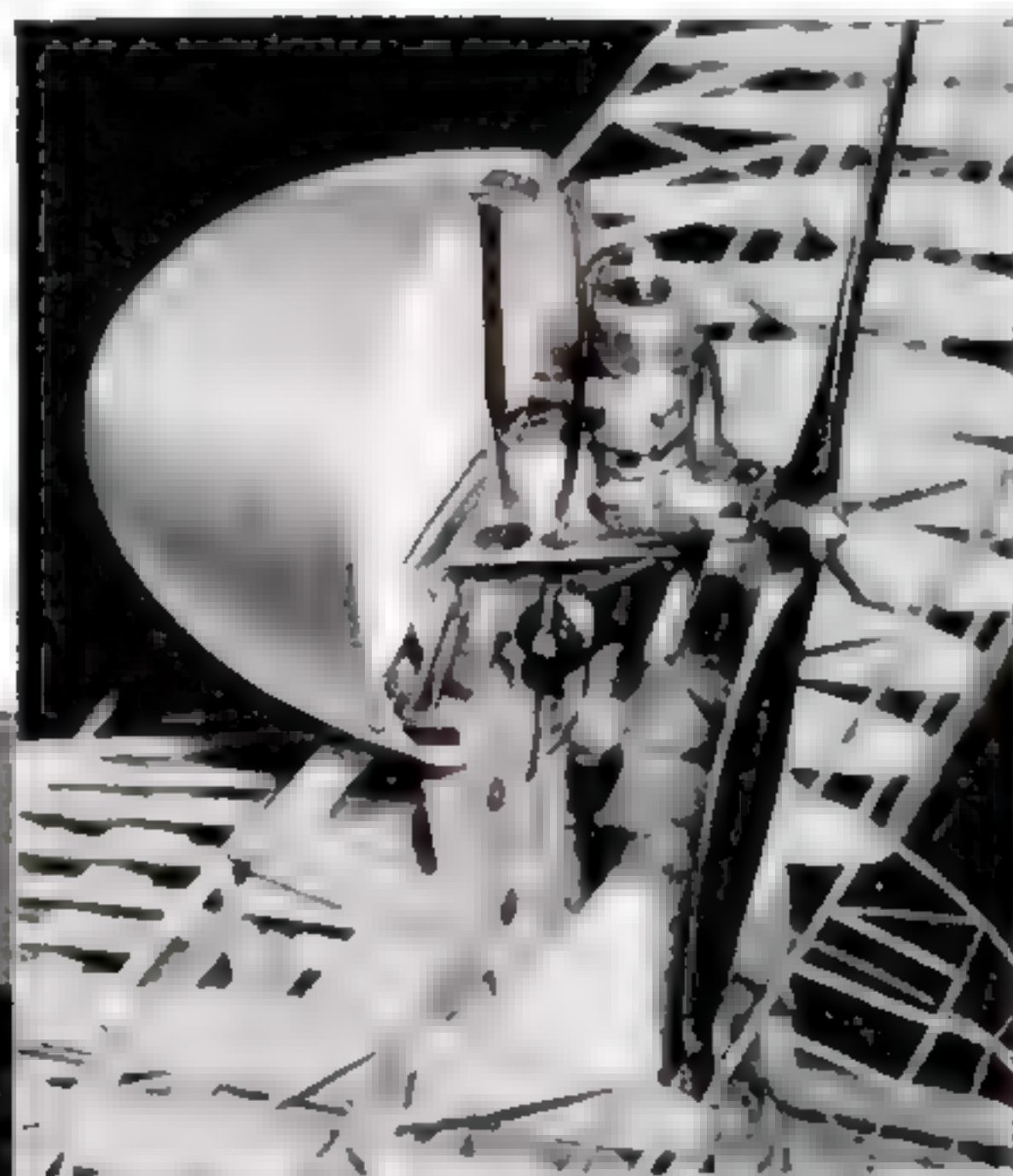
Dr. Charles Heck with two of his long-range heat-detecting devices

Detector Takes Air Temperature Mile Above Earth

MEASURING the exact temperature of the atmosphere high above the earth is the purpose of the giant hornlike device shown at the left, designed by Dr. Charles Heck, of North Carolina State College in Raleigh. Designed to help in forecasting changes in the weather, it takes the temperature of drops of water over a mile up. It is the outgrowth of a smaller device of similar design built by Heck (P.S.M., Dec. '38, p. 99).

Amphibian Model Has Ten-Foot Wing Span

MADE of about 3,000 pieces of balsa wood, each cut to fit with an old razor blade as the only tool, a novel amphibian, gas-driven model airplane constructed by John Abate, of Rochester, N. Y., is fitted with wheels which retract through sponsons that serve to balance the hull when the craft is afloat. The model has a wing span of ten feet, and is powered by a miniature one-fifth-horsepower gasoline engine mounted in a streamline aluminum housing on top of the wing.



This photo shows details of the gas-driven model after completion, but before covering was applied. Note how the motor is installed, in inset



A customer puts his glasses in the safety case

Barbers Furnish Holder for Customer's Glasses

AS AN added service, many barber shops are now providing an individual padded leather case in which a customer may place his eyeglasses to protect them while he is being shaved or having a haircut.

Man Bites Tender Hot Dog

HOT DOGS with tender skins are promised by a new process discovered by chemists of a Chicago meat-packing concern. Soaking the casings in pineapple juice softens cell tissues, making the skins easier to eat.

Truck Telltale Checks Driver's Report

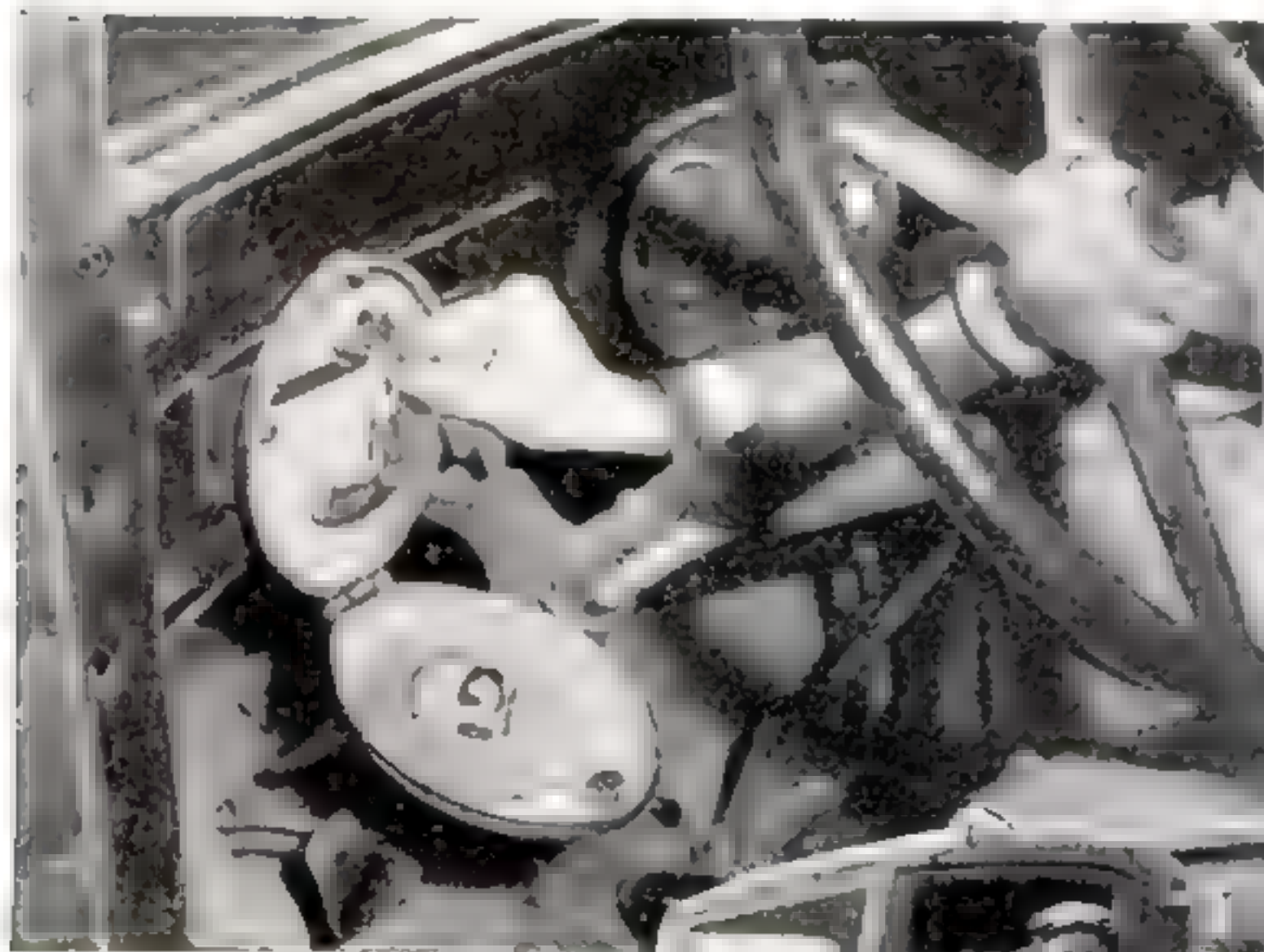
SUSPENDED from the dashboard of each truck operated by a California firm, a pendulum carries a small pen which traces a line on a clock-driven, rotating cardboard disk, to chart the truck's starts, stops, speed, and running time during a day's operation. The pendulum begins to swing when the truck starts, and moves through a wider arc as the vehicle increases its speed, thus

outlining the truck's movements on the disk, which is marked off in tenths of an hour, to check a driver's written reports.

Telltale mounted in truck cab. A pendulum traces a record of starts, stops, and speed on the disk



Reading the automatic log. Equipped with the telltale, the truck below traveled 310,000 miles without a single accident



Seal Hunter Supplies Zoos and Shows



Tangled in the net, the sea lion is being hauled into the skiff. Unharmful by the experience, it will be sold to a zoo, circus, or seal training camp

TRAPPING sea lions from an island rookery thirty miles off the coast of California is the unusual business of Capt. George M. McGuire. With two former cowboys as helpers, McGuire spreads a net across the mouth of an island cove into which the sea lions come. Then, whooping and yelling in the best Wild-West fashion, the trio frighten the animals into the net. Once entangled, the sleek sea lions are expertly lassoed, hauled into a boat, and shipped off to zoos, circuses, and seal training schools. Before McGuire started operations in 1902, seals were clubbed and hauled aboard a boat while unconscious.

'Chute Pack on Shoulders Allows Pilot More Room

BECAUSE he is unable to wear an ordinary seat-type parachute and still get into the cramped cockpit of his racing plane, Tony Le Vier, six-foot two-inch racing pilot, uses a novel headrest parachute that is said to be the only one of its kind in the world. Snapping onto a regulation harness, the chute rests on his shoulders and forms a pillow for his head. Notice the position of the rip-cord handle which Le Vier is grasping in his right hand in the photograph reproduced at the right.

Milady's Dressing Table Gives Day or Night Light

BECAUSE make-up applied to the face by daylight stands a good chance of appearing decidedly different in artificial light, specially lighted dressing tables are under consideration by a large eastern manufacturing concern. Buttons would turn on lights to simulate daylight or artificial light, as desired, and the user could thereby apply cosmetics suitable to the occasion.



Tony Le Vier with his unique parachute. Being over six feet tall, he just doesn't fit in the cockpit of his racing plane wearing a regular 'chute



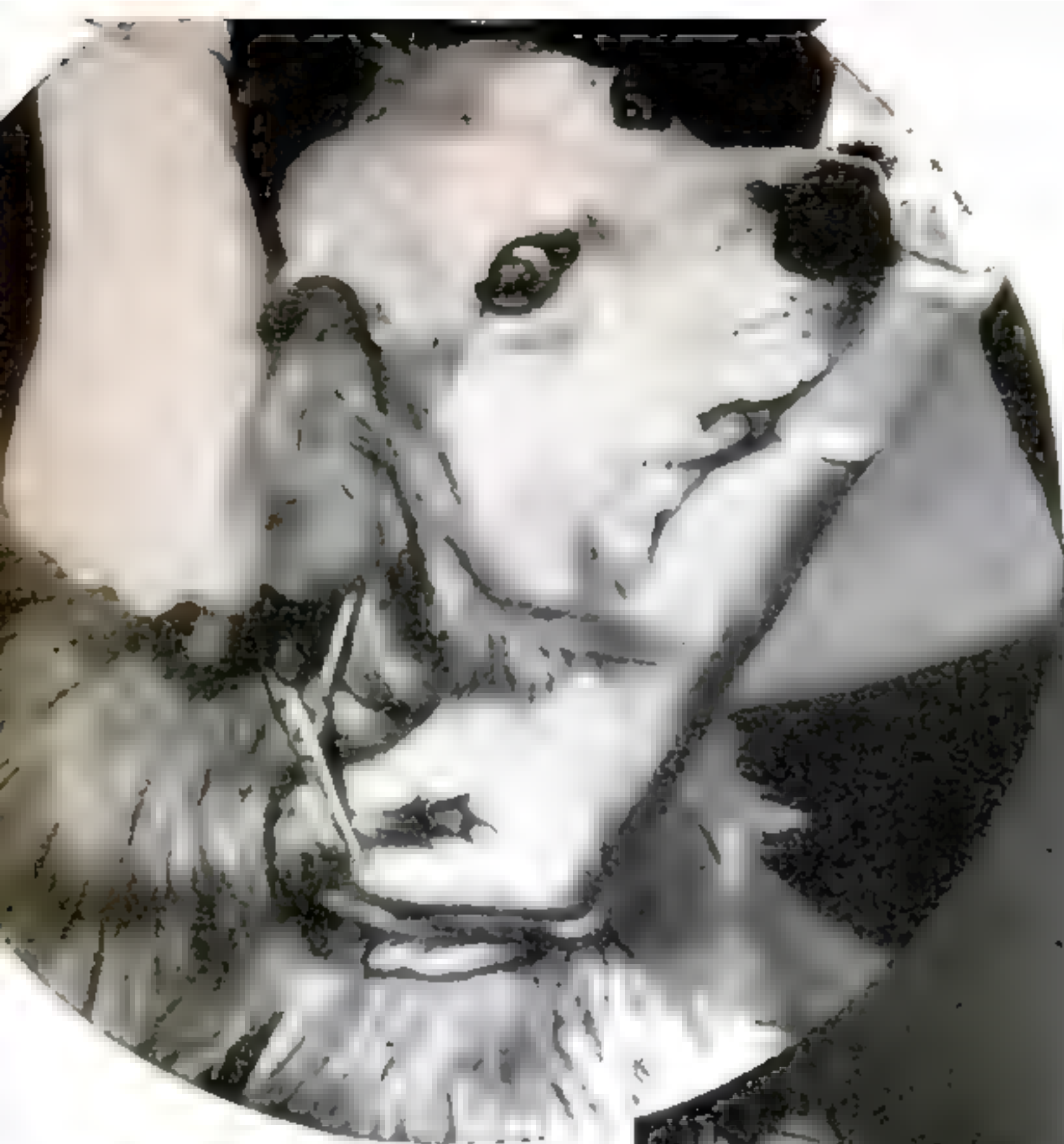
Historic Voyage Is Reënacted for Films

EIGHTEEN days out of the port of Cork, Ireland, her boilers fed by coal, several barrels of resin, and part of her deck planking, the steamer *Sirius* chugged proudly into New York harbor on April 23, 1838, the first ship in history to cross the Atlantic Ocean entirely by steam power. The epoch-making voyage has now been reënacted for a historical movie, with ancient sailing ships, rebuilt and rigged for the purpose, playing the leading roles. Filmed on the waters of the Pacific Ocean, off San Pedro, Calif., the movie sequences were correct in every detail, even to the interior shots of the *Sirius's* engine room, where Hollywood technicians duplicated the original ship's two-cylinder steam engine, a wheezing 320-horsepower plant that managed to push the 700-ton craft across the Atlantic at an average speed of about seven knots.



Paddle wheel of the first all-steam transatlantic vessel, reproduced on an old sailing ship. Above, a movie version of the end of the historic voyage

DRUGS



BOTTLING DOG HAIR. To prepare an essence of dog hair for an allergy test, a sample is first dried. Then all fat is removed in the apparatus above and a clear, almost colorless liquid is extracted

"**S** THAT essence of wood shavings ready yet? You know that carpenter may lose his job if he doesn't get it right away."

The nurse handed a tiny, red-stoppered vial to the laboratory chief.

"Here it is," she said quietly. "And we'll have the essence of saddle leather ready by tonight. That girl has to have it before the horse show."

Sounds crazy, doesn't it? Yet that is practically a verbatim report of a conversation at one of the largest modern allergy testing laboratories, at Burbank, Calif., where they distill the essence of almost anything that may cause irritation to sensitive humans.

For an allergy testing laboratory is a place of modern magic where they put a camel's-hair coat into a half-inch bottle, or

EXTRACTS CONCOCTED FROM ODD MATERIALS AID IN FIGHT AGAINST STRANGE AILMENTS

FROM DOG HAIR

make a sick woman well by distilling hair from her dog. It is a place where they collect dust, and grow weeds.

Just what does a doctor mean when he says you are allergic to a certain substance? He means that for some strange reason your system reacts violently and unpleasantly to that substance. The rash caused by eating strawberries and the hay fever resulting from breathing ragweed pollen are common allergic reactions.

When the existence of allergic reaction was first discovered, physicians were usually forced to test a patient by a laborious process of elimination. First one substance and then another was eliminated from the patient's surroundings and diet until the offender was eventually discovered. But if the essence of any given substance could be distilled and placed in a sterile bottle, then the job of testing would become simple and accurate. The answer was the modern allergy-extract laboratory.

Of course, the essences of many common substances, such as ragweed, strawberries, and eggs, can be prepared and kept in stock. But many people are sensitive to some substance in their own individual environment, such as the dust from their particular house, or something connected with their type of work.

Take the case of the carpenter already mentioned. Whenever he tried to work he was afflicted with such violent hay-fever reactions that he was forced to quit. Threatened with

losing his job, he went to an allergy specialist. But all the routine tests were negative. In desperation, the physician investigated the conditions under which the carpenter worked.

He noticed that the hay-fever attacks invariably came when the carpenter was planing or sawing certain kinds of wood. Shavings of these woods were sent to the allergy laboratory. There they went through the usual distillation and purifying processes.

First they were freed of moisture in a special drier. Next they were placed in a "defatting" apparatus. As the substance which causes an allergic reaction is always a protein, it is necessary to remove all fat. This is done by placing the substance to be defatted in the upper of two connected flasks. The lower flask contains ether, the fumes from which condense as they travel



WOOD SHAVINGS gave a carpenter hay fever. His trouble was diagnosed and cured with the help of an essence extracted from the shavings. Without this treatment, he would have had to change jobs

By

R. DEWITT MILLER

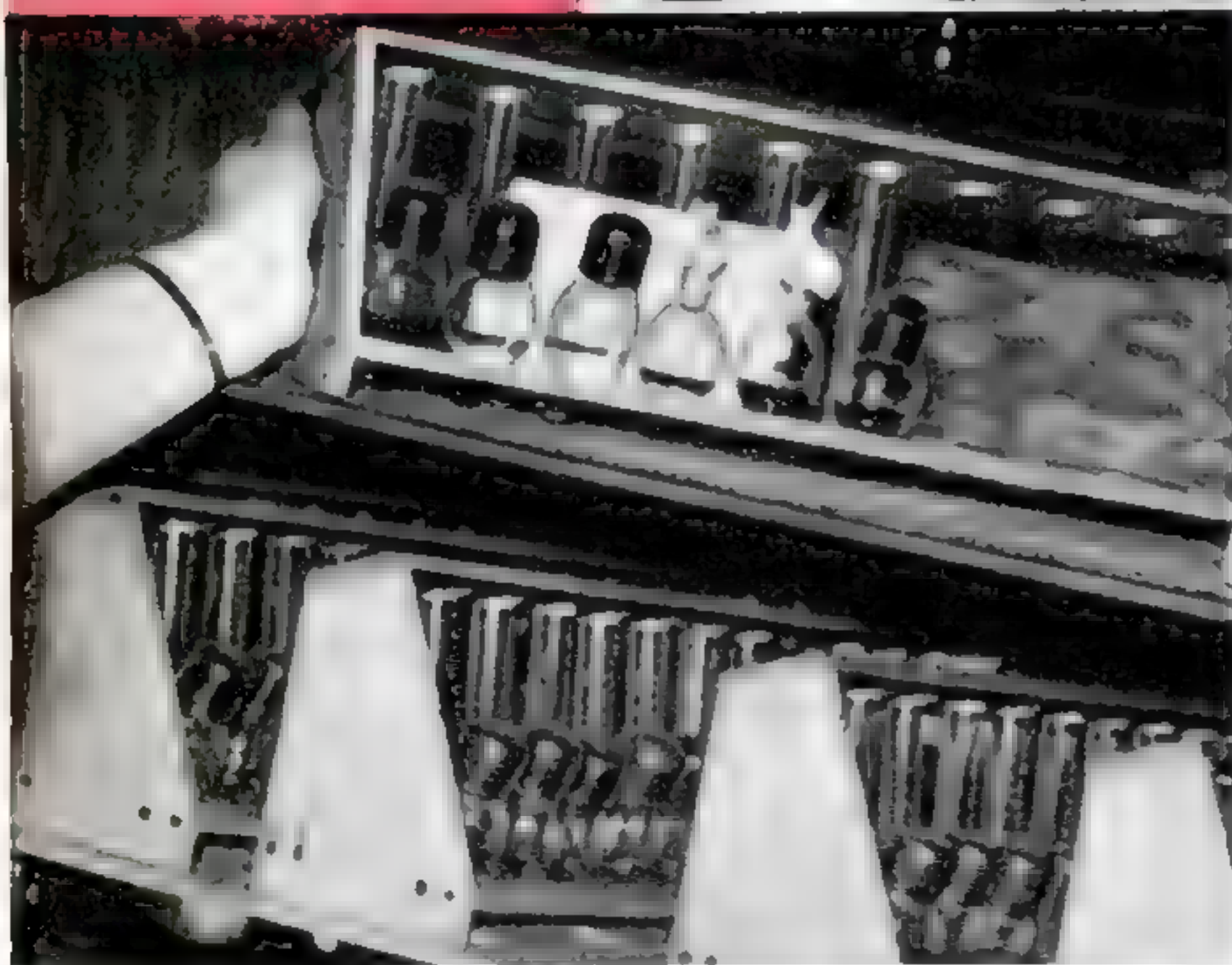




Materials for tests: Left to right, camel's hair, alfalfa hay, cotton mattress, chicken feathers, and cow hair. The cabinet at the left contains samples of 500 kinds of plant pollen

To reduce a substance to its essence, it is first cut up into small pieces and dehydrated in the drier at right

Extracted essences being placed in an incubator to test them for freedom from bacteria

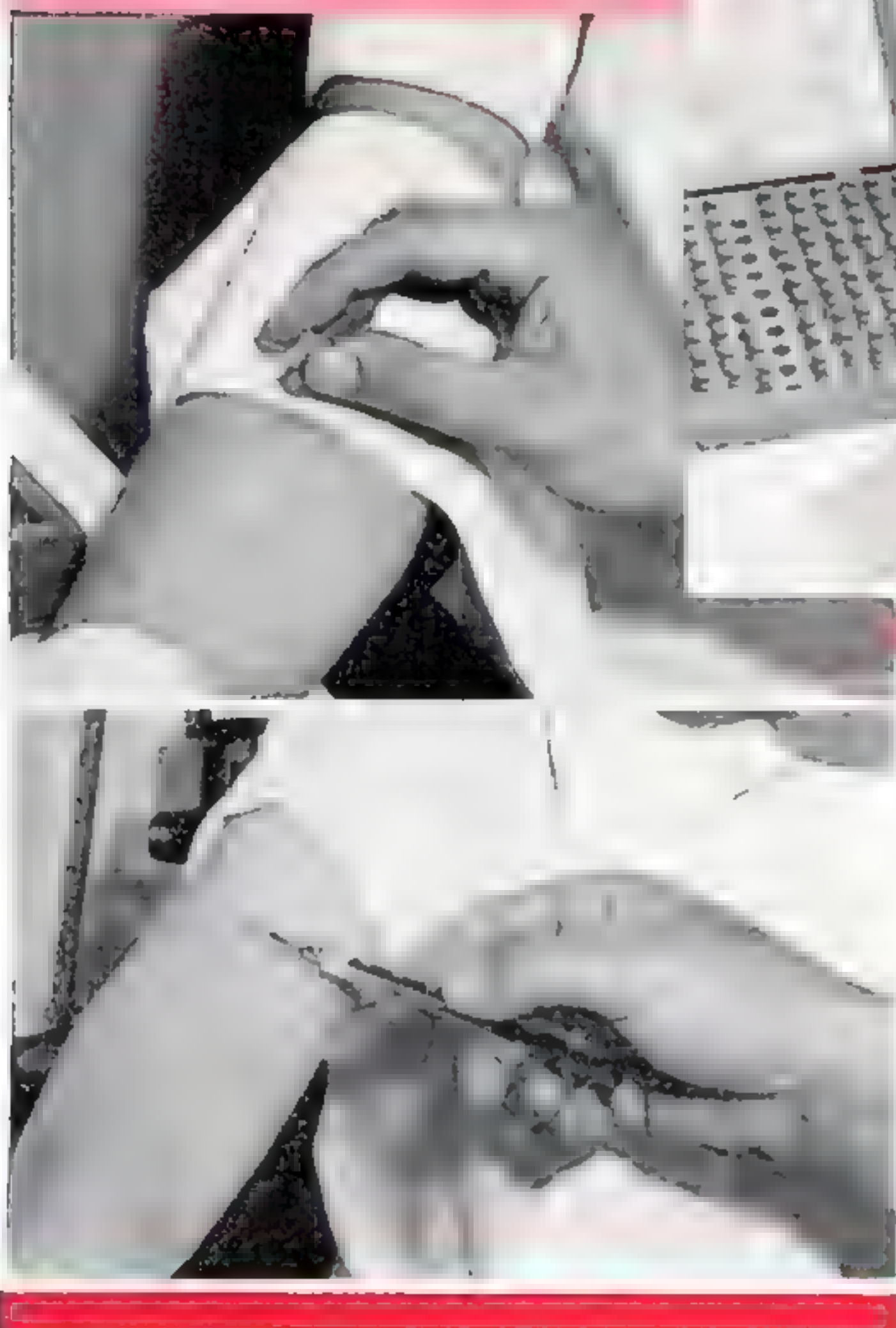


upwards, and pass through the substance being defatted. The ether fumes slowly carry the fat into the lower flask.

After being defatted, the wood shavings were again dried to eliminate the ether, then finely ground. Next the extracting substance was poured over the defatted powder.

The resulting liquid now contained the essence of those wood shavings which the physician believed had something to do with the carpenter's hay fever. However, it still lacked that ab-

Testing for allergic reaction. A scratch is made on the skin, as at right, and the essence of the suspected substance is applied. If the patient is allergic to that material, swelling results



A few years ago, there would have been nothing for the carpenter to do but go into some other trade. But now the magic liquid in the tiny vial could not only make the diagnosis, but also effect a cure.

For the modern method of curing an allergic condition is to give steadily increasing doses of the essence of the substance to which the patient is allergic. In a short time, the carpenter's resistance to wood shavings was built up so he could return to work.

Recently a rush call came to the allergy laboratory for the essence of several items connected with horseback riding. A well-known horsewoman believed that she was allergic to something associated with her riding equipment. If the offender could not be found, her career would be ruined. Saddle leather was discovered to be the guilty party.

solute purity necessary for accurate testing.

It was therefore sent through porcelain bacteriological filters and placed in a tiny glass vial. A few drops of the essence were removed with a sterile hypodermic needle, and put into a test tube. This was placed in an incubator. For two days it was kept at the temperature most favorable to bacteria. Then it was placed under a microscope and checked. Should any bacteria have developed, the essence of shavings would have been thrown away and the job done over.

When the essence of shavings was returned to the carpenter's physician, he made a test. This was done by slightly scratching the patient's arm and swabbing a few drops of the testing solution into the scratch. In certain cases it is injected directly into the skin with a hypodermic needle.

If the patient is allergic to the substance being tested, a swelling resembling hives will appear within ten or fifteen minutes. Our friend the carpenter got a rip-snorting reaction. The pale-amber liquid in the little vial proved he was sensitive to shavings.

ANOTHER highly important job recently undertaken by the allergy testing laboratory is the preparation of testing sets containing the essence of pollens and plants from a given area. In parts of the world where there are distinct seasons, a separate set must be prepared for each season. More than 10,000 such sets have been sent out, containing several hundred thousand bottles.

Although material for preparing many of the standard extracts is easy to obtain, some types are very difficult to collect from natural sources. Certain pollens are so fine and remain on the plants for so short a time that it is almost impossible to obtain sufficient quantities. In these cases the plants must be grown in gardens operated in connection with the allergy laboratory. These are probably the only gardens in the world where weeds are cultivated.



Prongs of a metal U grip the edge of the patient's mouth

Dental Lamp Clamps on Patient's Mouth

A LIGHT for illuminating the mouth of a dental patient, just placed on the market, clamps to the patient's cheek, thereby freeing him from the glare of external lights and relieving the dentist from the necessity of holding a small light in the patient's mouth. The unit consists of chromium-plated metal prongs formed in the shape of an elongated U, with one prong fitting inside the mouth and the other against the cheek. The inside prong acts as a reflector when indirect light is desired, while a shade may be adjusted to give a direct beam.

All-Metal Stretchers

STRETCHERS made entirely of metal are now being used in England in first-aid stations set up in readiness for enemy air raids. The tubular frames are bent near the end to form legs. Fitted with metal springs, the stretchers are much stronger and will stand considerably more abuse and hard usage than wood-and-canvas types.



Stretchers stored in an emergency first-aid station



Outlet-Cord Adapters Fit Almost Any Socket

NO MATTER what type of electric outlet a tourist finds on his travels, he can be sure to have the use of his electric razor or other electric appliance if he carries a set of plug adapters, now available. The kit, shown in the photograph reproduced above, provides an extension cord and various styles of adapters for use with practically any kind of electric socket.

Bugs Flown to Work Here

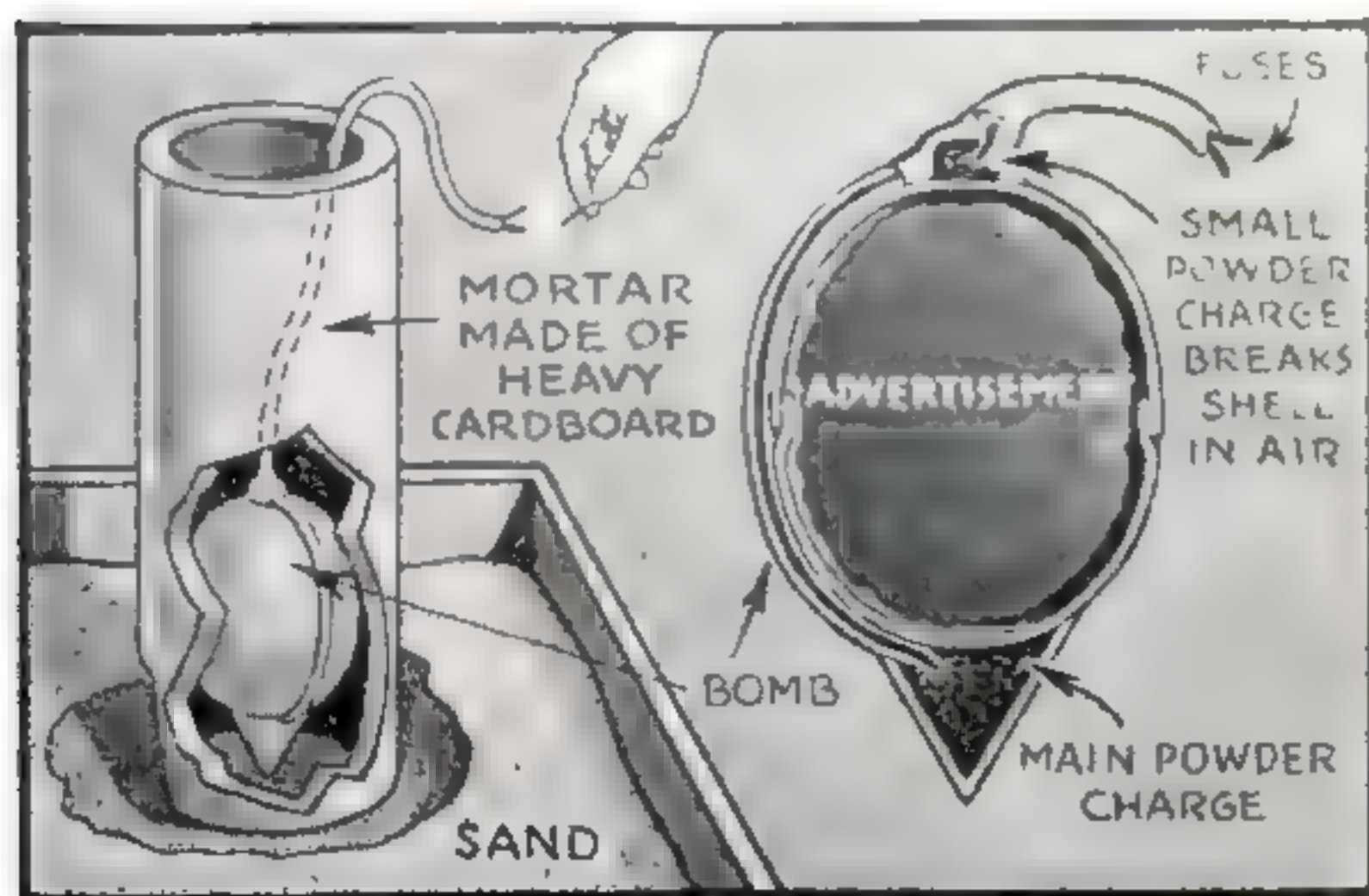
FRIENDLY insects for fighting beetles that attack asparagus made an unusual shipment in a recent transatlantic flight of the Pan American Airways *Atlantic Clipper*. Sent by the U. S. Department of Agriculture's European field station near Paris, France, the flies were to be turned loose in this country to carry on their good work of killing parasites.



Air Bomb Releases Sky Advertisement

BURSTING high overhead with a loud explosion to attract attention, a novel aerial bomb for advertising purposes has just been introduced. At the first glance, spectators see only a huge cloud of smoke as the bomb bursts. In a moment, the smoke clears and a giant object—an oversize copy of the bottle, food package, automobile tire, or other product being advertised—is revealed floating in space. Made of lightweight, silky paper, the advertisement weighs only about nine ounces, though it may have a surface area of sixty-five square feet and be as much as fifteen feet in length. It requires from two to ten minutes to float back to earth, being borne up by rising air currents entering a hole at the bottom. Weights at the bottom hold the parachutelike advertisement upright. Developed for use wherever large crowds gather outdoors, the compact bomb is shot from its mortar at a safe distance. It rises 360 feet before a time fuse explodes it, and the giant “flying signboard” is released. At a seaside resort, the practice is to shoot the bomb aloft from a boat cruising a short distance off the bathing beach.

How the aerial advertising bomb is fired. On bursting, it releases a balloonlike copy of product advertised

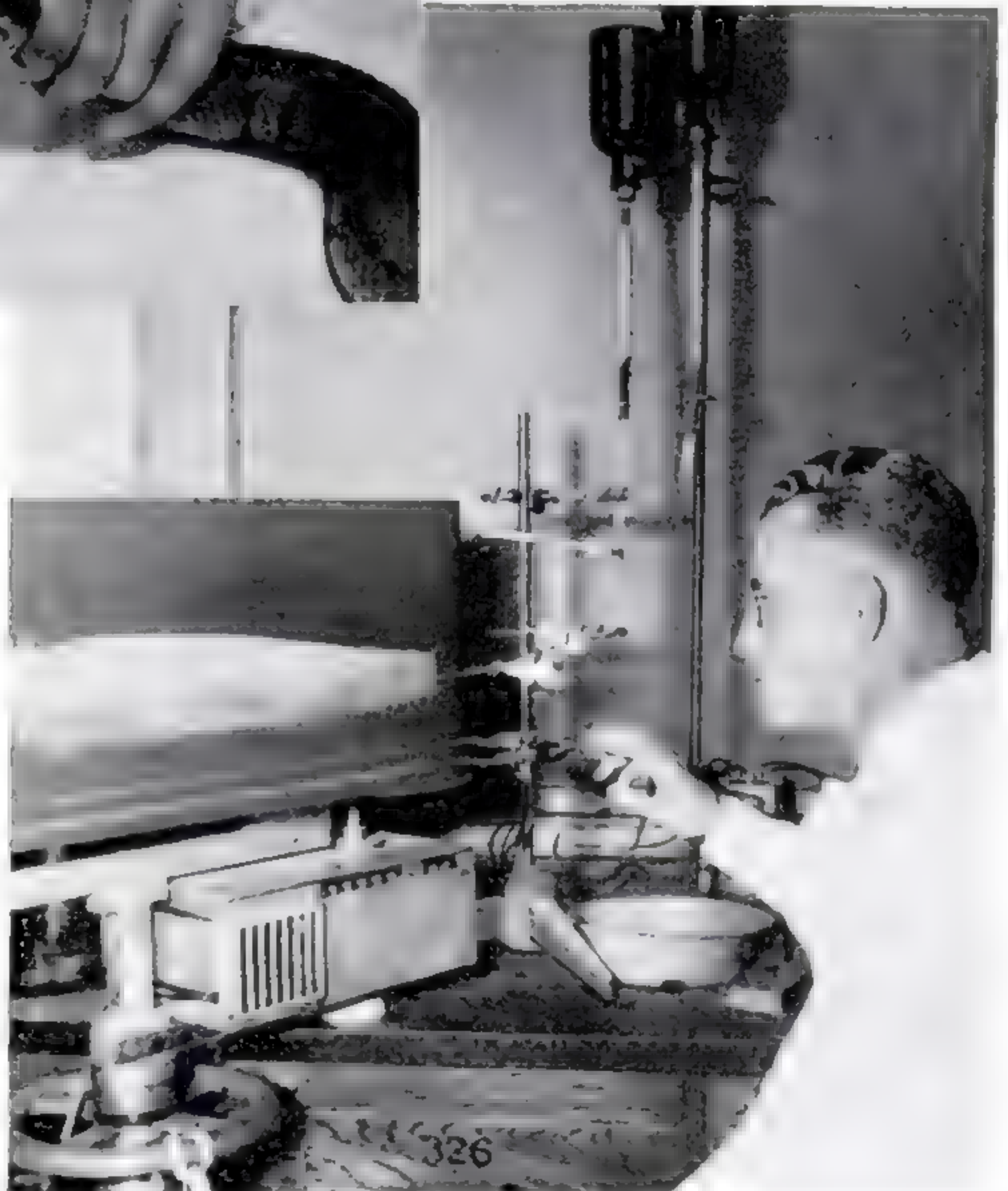


Can Deadly Snake Venom Save Lives?



"Milking" a water moccasin of its venom by causing it to bite into oiled silk stretched over a bottle

EXACTLY how does the venom of a deadly water-moccasin, a snake native to the southern United States, act on the vital processes of a human being? That is the problem being tackled by Prof. Robert V. Brown, University of Chicago physiologist, who believes that the answer may provide a way to control hemorrhage and falling blood pressure, for, he states, small doses of moccasin venom have already been used to decrease the susceptibility of human beings to hemorrhages. Five of the deadly snakes are kept in Professor Brown's laboratory, and "milked" regularly by causing the reptiles to bite into oiled silk stretched over the neck of a bottle.



Recording the effect of venom on living heart of a frog (at arrow)

"Sight" Chart Tests Television Camera



The odd patterns test a television camera's focusing ability

FLARING vertical and horizontal lines of various widths and spacing, solid and open squares, rectangles, and other shapes form a queer chart developed by General Electric engineers for checking the adjustment and operation of television cameras. Said to test the "sight" of the television camera eye in much the same manner as human sight is checked by means of the optician's wall chart, the device is set up in front of a television camera lens. The sharpness of the chart's details on the receiving screen then indicates needed adjustments.



Down Is Up for This Upside-Down Plane

IT MAKES little difference to Michael Murphy, stunt flyer, and his mechanic, Eddie Leach, whether they land their new plane right side up or upside down. For the novel monoplane is fitted with two sets of landing wheels, one in the usual position and the

other on top of the plane. Two cockpits are also provided, so that one pilot is always flying upside down. Incidentally, can you tell by the photograph whether the craft is a high-wing monoplane right side up or a low-wing monoplane upside down?



Cable Drill Clears Sewer Pipes

IN THE odd photograph below, it looks as though some Simple Simon were trying his luck at fishing in a city sewer. However, the picture actually shows a special drilling apparatus that draws a steel wire through a sewer pipe, and cuts off any tree roots growing between joints.



Any tree roots growing into a sewer pipe are cut away by this unit

License-Key Chain for Motorists

LICENSE HOLDER and key chain are combined in a novel accessory for motorists. Rolled up, a driver's license or registration certificate is inserted within a hollow tube of plastic material which is attached by a chain to the ignition key of the car. Thus the driver is sure to have the license with him whenever he drives.

LATEST IDEAS FOR

New Print Drier Utilizes Heat of Electric Bulb



Wet prints are placed in contact with the cylinder and held in place with a canvas cover. The cylinder is then placed over a lighted bulb

USING the heat of an ordinary 100-watt electric bulb to dry photographic prints, a simple device recently introduced for amateurs permits quick drying and ferrotyping in a minimum of space. The drier consists of a cylinder of chrome-coated metal and a canvas cover. Glossy-paper prints are pressed on the outer surface of the cylinder by means of a roller or squeegee. After the canvas cover is fastened over the prints, the cylinder is slipped over the 100-watt lamp, which hastens drying without injuring the prints.

Hand Generator Fires Flash Bulbs

WITHOUT the use of batteries, a new photoflash outfit sets off the artificial illumination by means of current generated within the base of the "gun." By pressing a hinged lever on the side of the base, the operator spins a tiny dynamo within the handgrip to produce the needed flow of electricity. According to the manufacturer, the device lasts many years.

Tool Simplifies Film Splicing

A NEW tool for use in splicing home-movie film is a square metal tube with a sponge and scraper at one end and a rubber bulb at the other. Squeezing the bulb forces water into the sponge for dampening the emulsion that is to be scraped away, after which the splice is made in the usual way.



This device provides both moisture and a sharp blade for scraping film. At right, squeezing the lever in the handle turns a generator to fire the flash bulb



CAMERA FANS

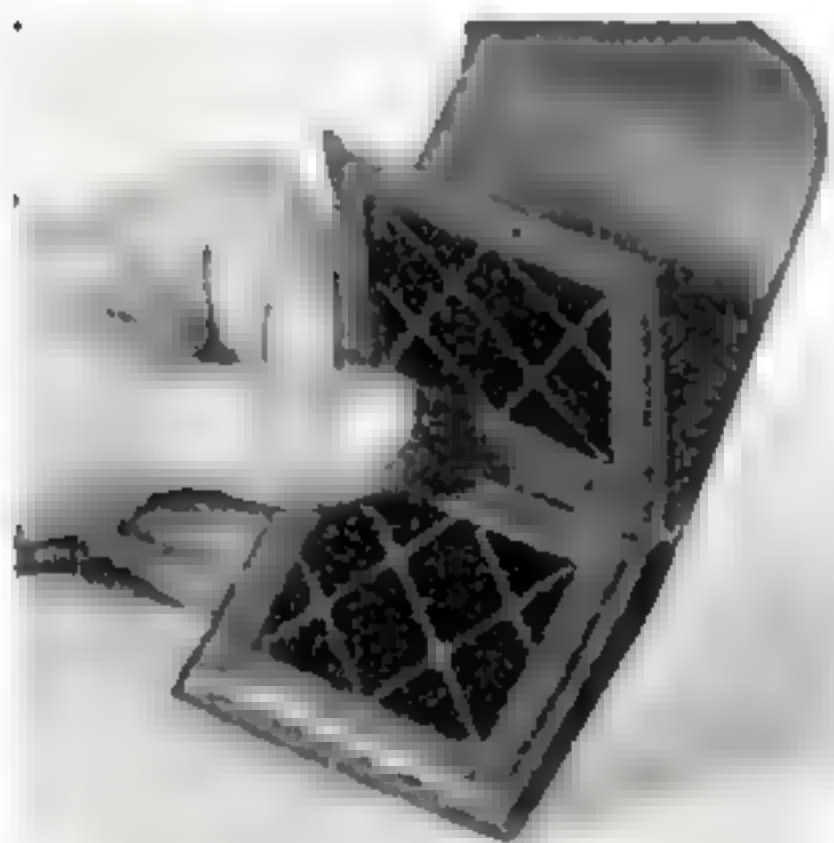
Home-Movie Camera Gets Range Finder

CLOSE-UP shots with a well-known make of American home-movie camera are simplified through the use of a new range-finding mechanism which enables the operator to see exactly what will be recorded by the film and to be sure the objects are in perfect focus. To use the new range finder, the camera is set on a tripod, the film magazine chamber is removed, and the device is attached in its place. After the focusing has been accomplished, the magazine chamber is replaced and the picture is made.



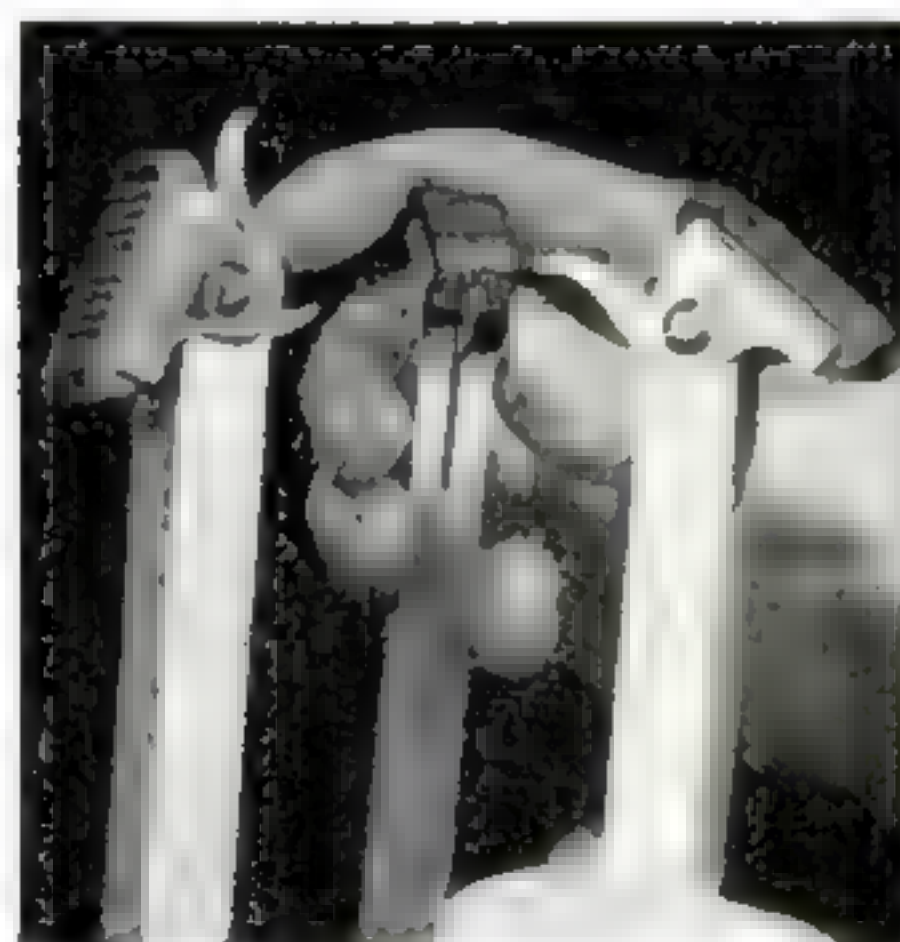
For accurate close-up focusing, the unit shown at left is inserted in place of the magazine chamber of the movie camera

Viewer Aids in Photo Composing



Note how the pocket-size viewer opens up for use. Sighting through it aids composition

TO HELP amateurs get good composition in their pictures, a pocket-size, translucent viewing screen is now available. On the screen is a symmetrical pattern of thin lines as a guide for arranging subjects of interest. Looking through the screen, the photographer finds the best arrangement of his material, then sets up his camera to take in the identical view. The screen also shows how a finished picture will appear.



Tripod Feet Grip Floor or Ground

Handy Brush for Darkroom Use

DESIGNED for removing dust particles and pieces of lint from the surface of a negative before it is placed in an enlarger, a new aid to producing better results in the darkroom is a wide, lightweight camel's-hair brush. A hole at the top of the brush permits it to be hung up out of the way when not in use. The handy brush is shown in the illustration at the right.

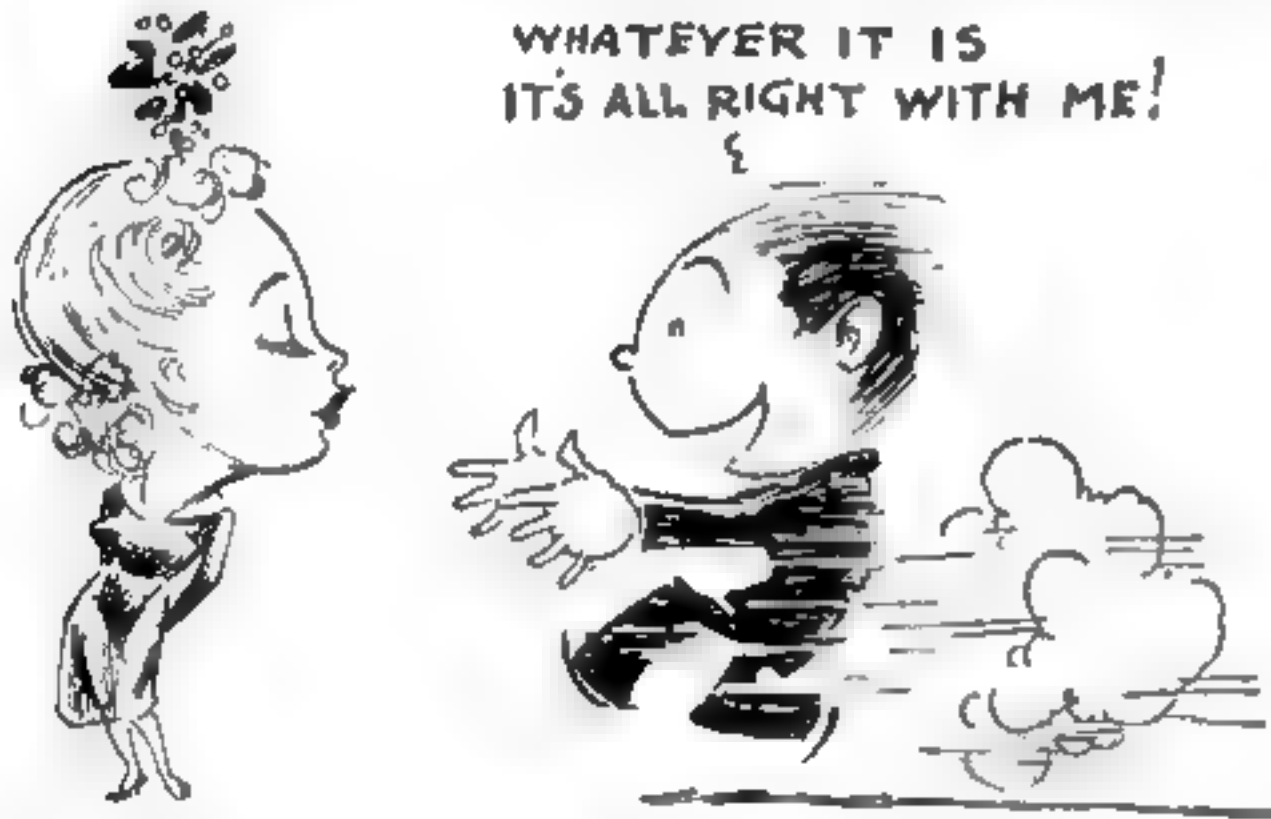


METAL points for outdoor use and rubber grips for indoor use are provided on the feet of a new tripod just marketed by a western manufacturer. Pivoted at the lower end of the three legs, the feet and points form single units. For outdoor use, the rubber foot is folded up bringing two steel points down to grip the earth; indoors, the points are turned upward and the nonskid rubber surface comes in contact with the slippery floor.

POPULAR SCIENCE

Question Bee

Give your I. Q. a workout on these tricky questions. You'll find the correct answers on page 246. If you don't fall down on more than four of them, you can consider yourself fairly well informed



- 1 Mistletoe is (a) a kind of evergreen tree (b) a parasitic shrub (c) a fern (d) a member of the thistle family.
- 2 In an automobile, the distributor regulates the flow of (a) gasoline (b) oil (c) electricity (d) water.
- 3 Divers working at great depths now avoid the "bends" by breathing oxygen and (a) chlorine (b) methane (c) helium (d) nitrous oxide.
- 4 Cormorants lay (a) cornerstones (b) eggs (c) smoke screens (d) railroad tracks (e) submarine mines.
- 5 When photographs are taken, light acts upon compounds of (a) tin (b) aluminum (c) silver (d) radium.
- 6 Meteors rarely strike the earth because (a) the moon's gravity pulls them away from the earth (b) most meteors do not travel fast enough to catch up with the earth (c) the friction of the atmosphere heats and destroys them.
- 7 Given different-shaped fields of exactly the same area, the one that can be surrounded by the shortest fence will be (a) square (b) circular (c) triangular (d) oblong.
- 8 When a chemist writes the symbol "Fe" he means (a) fluorine (b) feldspar (c) iron (d) mercury.
- 9 How many times a pendulum swings in a minute depends upon (a) the length of the pendulum (b) the weight of the bob (c) the length of the arc.
- 10 Even a landlubber should know that "weighing the anchor" means (a) putting heavy weights on it in rough weather (b) pulling it up from the bottom (c) seeing whether it complies with a legal standard.
- 11 Moonlight is produced by (a) the heat of the glowing moon (b) reflected sunlight (c) phosphorescence of the moon's rocks.
- 12 Two equal and opposite forces, acting so as to produce a twisting motion, are called a (a) doublet (b) couple (c) dipole (d) tandem (e) binary (f) swivet.
- 13 There is usually a small space between the ends of rails, in railroad tracks, to (a) prevent stray electric currents from interfering with signals (b) allow for expansion (c) make the rails easier to replace.
- 14 Placing an object in a vacuum (a) increases its weight (b) decreases its weight (c) does not affect its weight.
- 15 A tarpon is (a) a weapon for killing whales (b) a rainproof fabric cover (c) a plug for the muzzle of a big gun (d) a kind of fish.
- 16 You could see the wave form of alternating current with (a) a pantograph (b) an oscillograph (c) a chronograph (d) a cardiograph.
- 17 Cyanides should be used with care because they are (a) explosive (b) poisonous (c) breakable (d) habit-forming.
- 18 A meniscus lens would probably be found in (a) a large astronomical telescope (b) a lighthouse tower (c) a cheap box camera (d) a compound microscope.
- 19 The retina is part of the (a) nose (b) eye (c) ear (d) larynx.
- 20 If a large passenger liner sailed out of New York and went mysteriously unreported thereafter, at least you could be certain that it was not at a seaport in (a) Spain (b) Ecuador (c) New Zealand (d) Switzerland.

Un-Natural History *By Gus Mager*

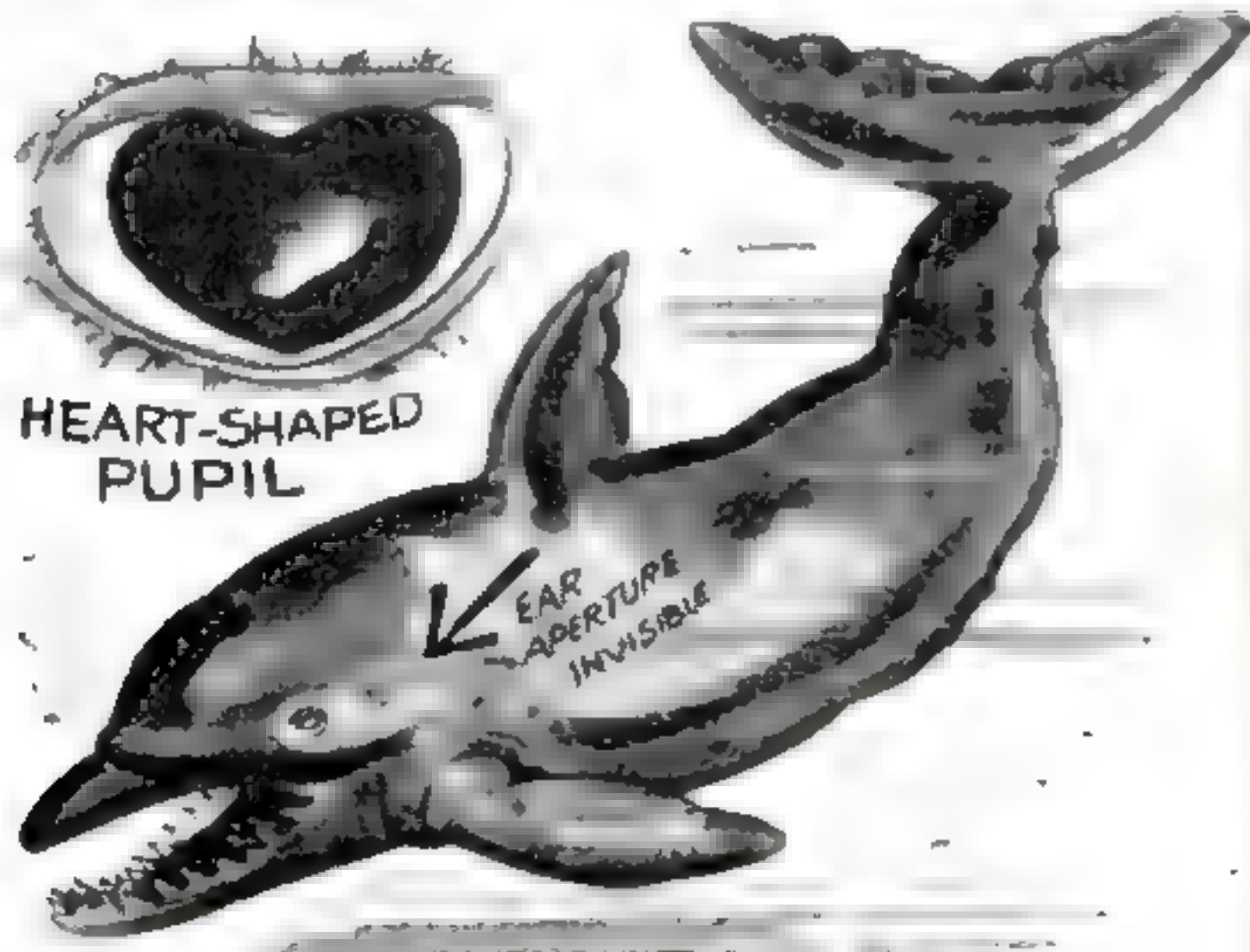


AFRICAN **TOURACOS** CHANGE COLOR WHEN THEY GET WET! CERTAIN FEATHERS UNDER THE WING HAVE A PIGMENT THAT "RUNS," TURNING THE COLOR FROM GREEN TO RED!

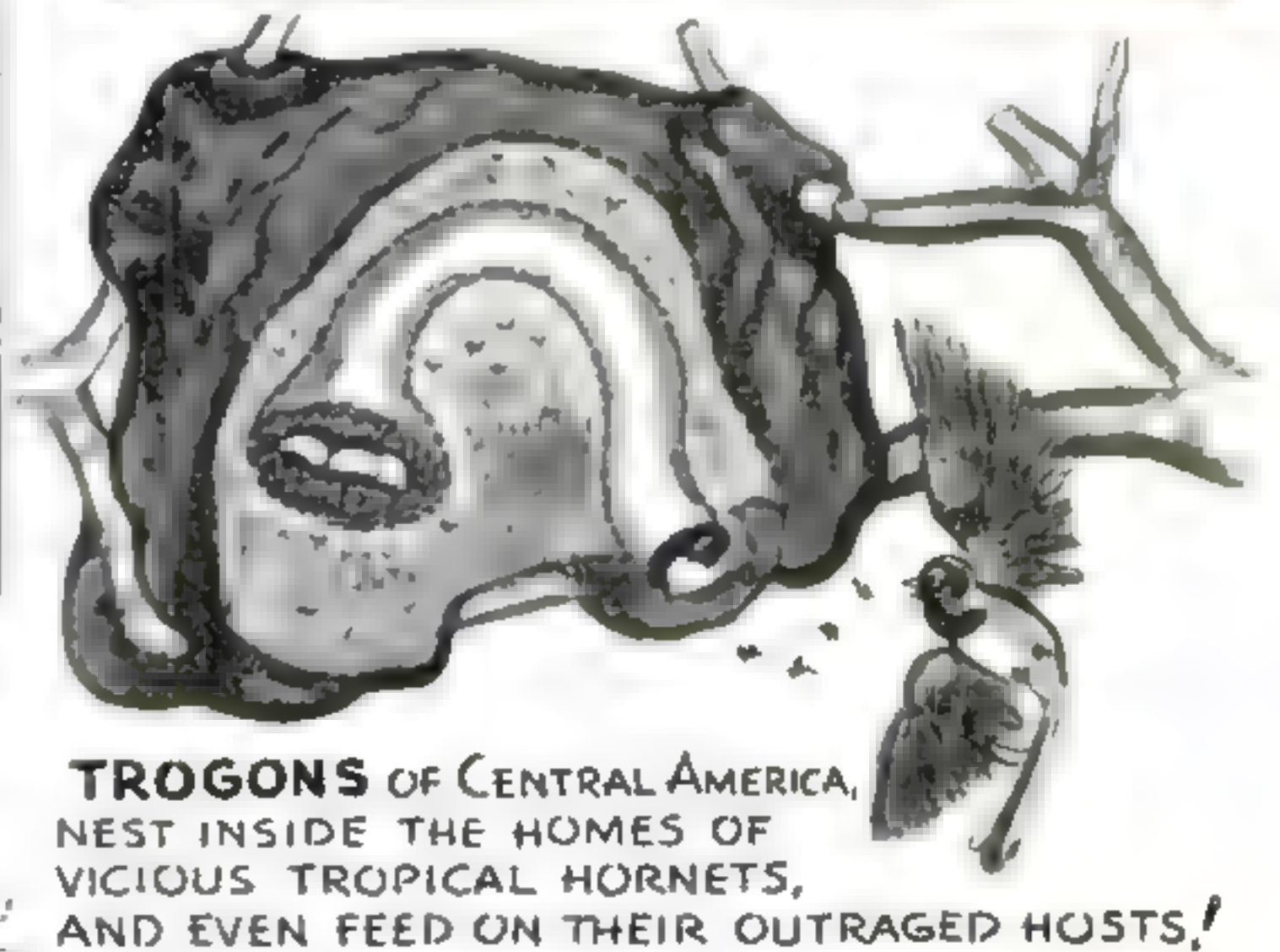


IN RELATION TO ITS SIZE, THE **KIWI** OF NEW ZEALAND LAYS LARGER EGGS THAN ANY OTHER BIRD IN THE WORLD!

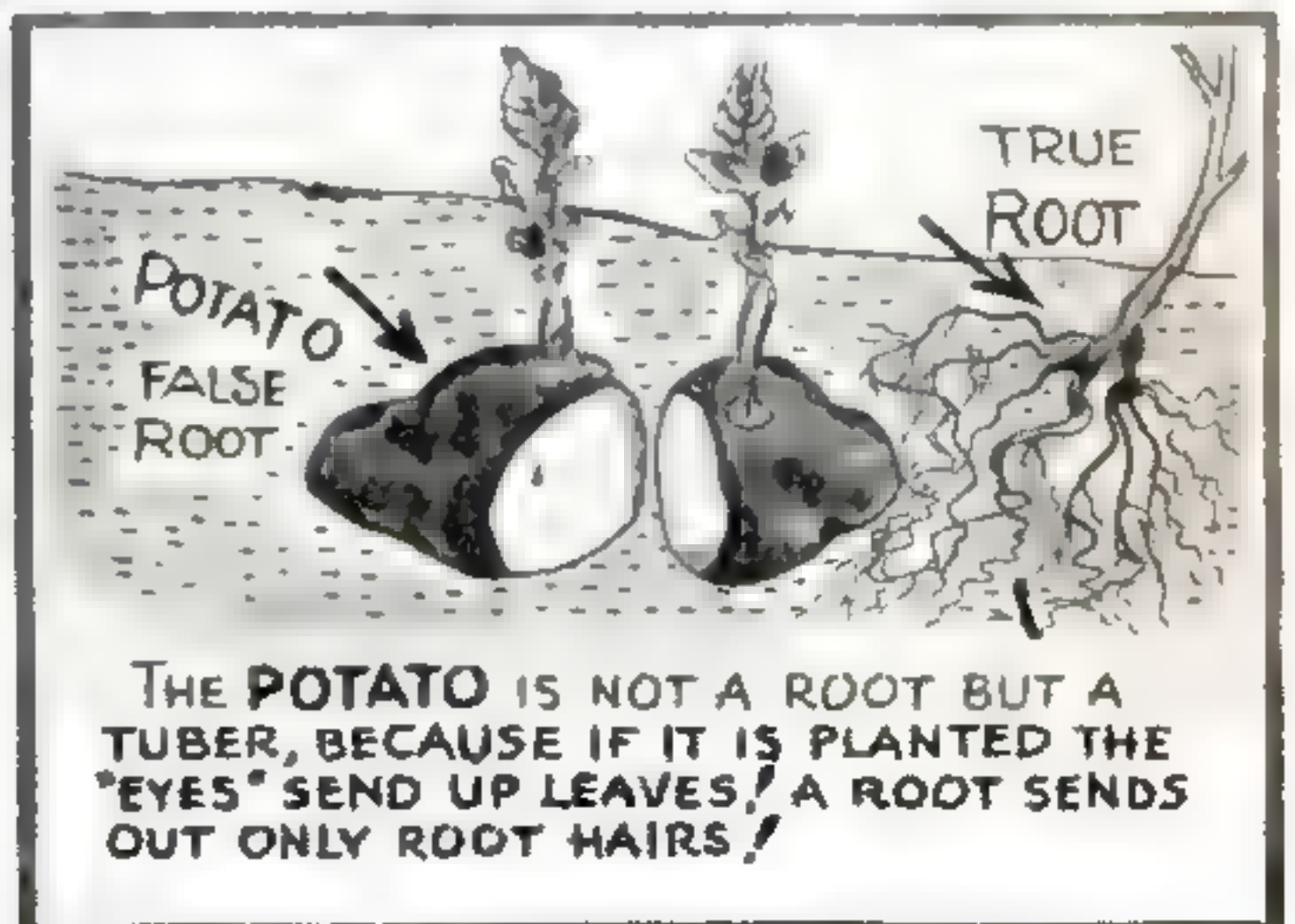
LIKE OTHER MAMMALS, THE **DOLPHIN** HAS EYELIDS, BUT THE PUPIL OF THE EYE IS HEART-SHAPED! AND THE EAR OPENING IS SO SMALL IT WILL HARDLY ADMIT A PIN!



COMPARING THE TINY SIZE OF **TERMITES** WITH THE HEIGHT OF THEIR BUILDINGS, WE SEE THAT THESE INSECTS ORIGINATED THE SKYSCRAPER! WISER THAN HUMANS, HOWEVER, THEY BUILD IN PYRAMID FORM!

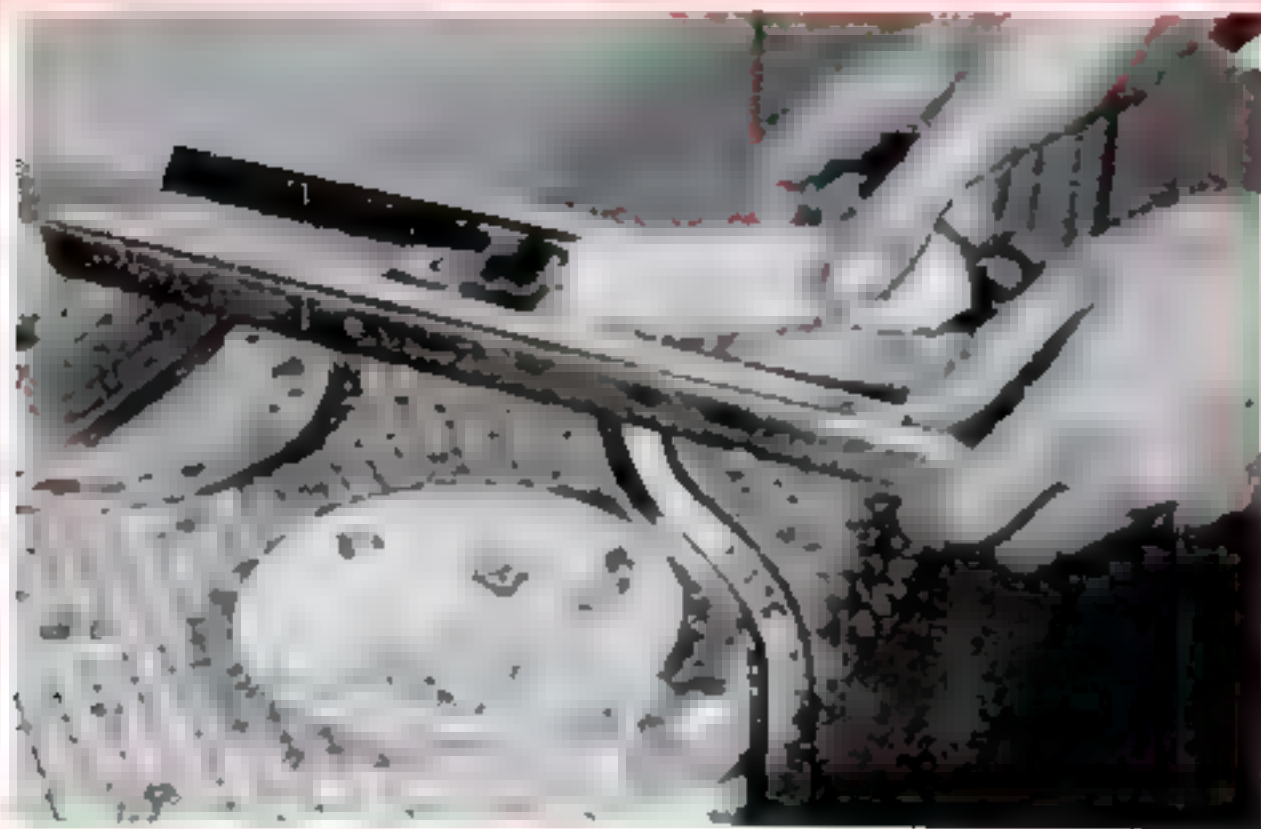


TROGONS OF CENTRAL AMERICA, NEST INSIDE THE HOMES OF VICIOUS TROPICAL HORNETS, AND EVEN FEED ON THEIR OUTRAGED HOSTS!



THE **POTATO** IS NOT A ROOT BUT A TUBER, BECAUSE IF IT IS PLANTED THE "EYES" SEND UP LEAVES! A ROOT SENDS OUT ONLY ROOT HAIRS!

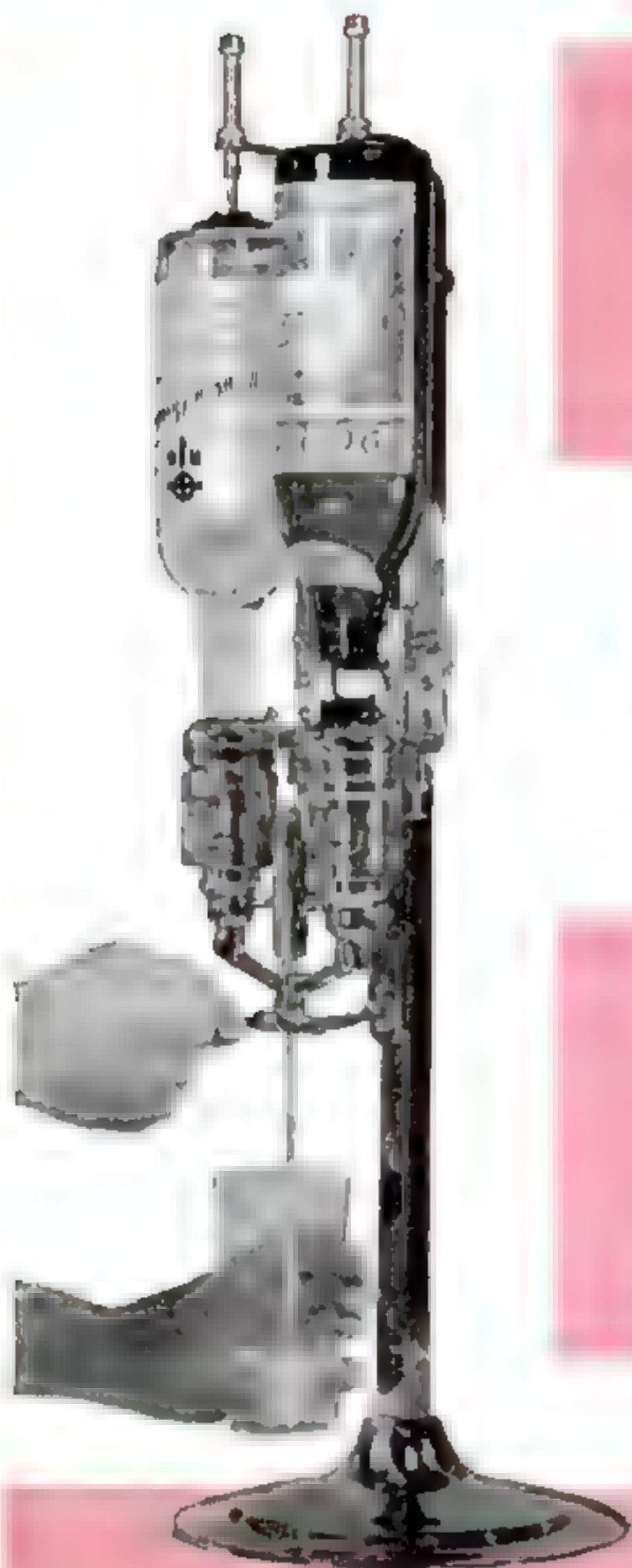
Conveniences for the



CORN CUTTER. Kernels come off whole when an ear of corn is slid along this metal trough



CLOTHESLINE TIGHTENER. A few twists with the device above take the sag from a line



BEVERAGE DISPENSER. Cocktail ingredients are automatically mixed in the right proportions with the novel liquid dispenser shown above



HANDY SLICER. Operated by turning a hand crank, a new kitchen accessory works like the larger machines that are used in stores, to slice up meats, vegetables, fruits, cheese, and bread



SNAP-ON APRON. Even Mother can escape from apron strings if she wears this new dress protector. A steel spring holds it snugly around the waist

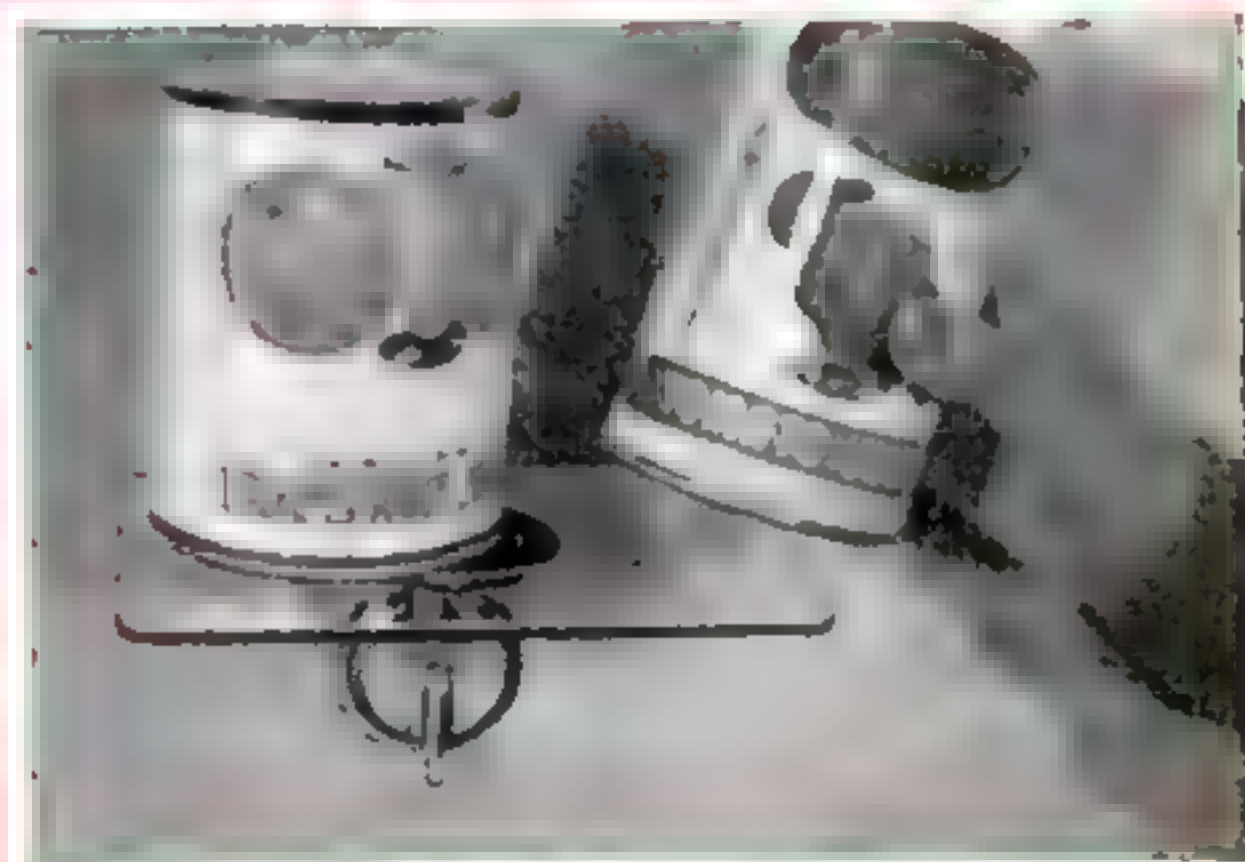


Housewife

VERSATILE HAMPERS. The bathroom hamper at the right has a large vanity tray built into its top, which is easily turned out for use as shown. There is plenty of room for cosmetics. Below is another hamper that has a built-in receptacle to dispense cleansing tissue



**VITALIZES
TAP WATER**
Slipped onto
any faucet, the
attachment at
left aerates the
water and filters
out impurities



**SUCTION-CUP SHELF
SUPPORTS.** Extra shelves
can be installed on a tile
wall with a novel support.
Pulling a lever creates a
vacuum in the suction cup
that supports the bracket.
Another cup grips the shelf



STREAMLINE NUTCRACKER. The limited
motion of this new nutcracker makes it easy to
crack shells without mashing meats or fingers

Gus Takes a Holiday

By
MARTIN BUNN

EVER since the World's Fair opened, Gus Wilson had been saying that he was going to take a day off and get a preview of what the world is going to be like tomorrow. But the Model Garage was even busier than usual all summer, so Gus kept putting off his holiday.

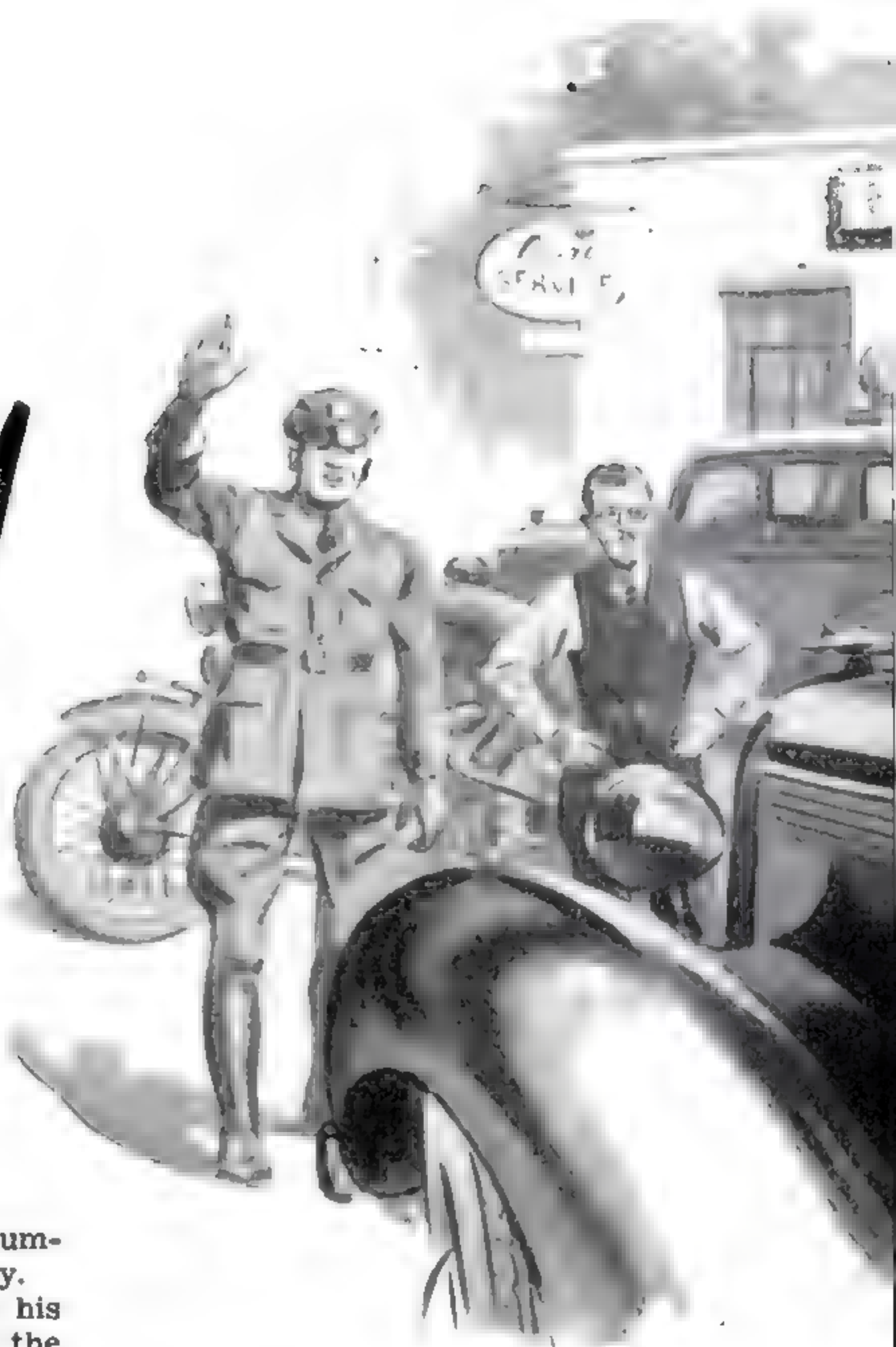
Autumn was well under way when his partner Joe Clark, who had been to the Fair a half dozen times, built a fire under Gus with the observation that if he didn't get a move on he'd find the big show closed and boarded up when he finally got to it. Only then did Gus break down and say that he'd go the following day.

So the next morning he left home in his car at about his usual time, headed for the Fair. First, however, he took a look-in at the Model Garage.

"Just wanted to make sure that everything's going along all right," he told Joe



"Try her again," Gus said. This time it started



with a slightly sheepish grin on his face.

"On your way, Gus!" his partner said coldly. "Beat it! Get the heck out of here! There's a lot worth looking at over there at the Fair, and you're wasting time."

Gus grinned, and started filling his gas tank at the pump. Before he had finished, a business coupe stopped beside him, and when he looked up he saw that it was driven by Harry Meyers, a drug salesman who always stops at the Model Garage for servicing when he is in town.

"Good morning!" Gus said. "Joe will take care of you in just a moment. I'm taking the day off. Going to the Fair."

"Swell!" Meyers approved. "But, say—have you got just a minute to spare? I'm having trouble with my car, and I've got a busy day ahead of me."

Gus hesitated. "What kind of trouble?" he asked.

"Starting trouble. And I can't understand it—never had any before, with this bus. I had to stop and get some gas at a filling station about five miles down the

Joe Clark and a state trooper Gus didn't know were standing near his car, both looking serious



Why Is It That a Day Off Just Never Is an Off Day? Gus Tried To Figure That Out All One Busy Morning

road—couldn't make it to your place. When I tried to start—nothing stirring! The two fellows at the filling station took a look at the wiring, but couldn't find anything wrong. Then a grocery boy came along in a delivery wagon, and I got him to push me until I could get started again."

"Switch off your engine," Gus said. "All right. Now try to start it again."

Meyers stepped on his starter. Nothing happened.

"Humph!" Gus grunted. "Did those fellows at the filling station do anything to your car except fill your gas tank?"

"They checked the oil and water, the way they always do, but I didn't need either."

Gus raised the side of the hood nearest to him. "Try her again."

Meyers stepped on the starter again. Nothing happened, except that under the hood, somewhere on the side of the engine away from him, Gus saw a spark flash.

"Wait a minute," he said. He closed his side of the hood, walked around the car, and raised the other side. "Now again."

Again Meyers stepped on the starter. And again the spark flashed. This time Gus saw where and why it flashed. The bayonet-type oil-gauge rod, instead of having been returned to its proper position after the oil had been checked, had been left lying across the starter, with one end resting against an exposed starter-switch terminal. Whenever the circuit was closed by the starter pedal being pressed down, the exposed terminal became "live," causing the spark Gus had noticed, and grounding out the starter.

Gus pushed the oil-gauge rod back into its place without saying anything. "Once more," he then told Meyers. This time the engine took off perfectly.

"You're all right now," Gus said. "No damage done."

Meyers wanted to know the cause of the trouble, so Gus had to tell him.

"Well," he concluded, "now you're fixed up, I'm off for the . . . 'Morning, Doc!"

"Good morning, Gus," Dr. Marvin said, getting out of his car. "I didn't expect to see you here. You said that you were going

\$100 in Prizes FOR GARAGE MECHANICS

Do you work in a garage, or maybe own one? Then at some time you have come up against a car ailment that had you all tied up in knots trying to solve. Martin Bunn wants to know what the trouble was and how you found and fixed it. For the most interesting letter of not more than 500 words describing the ailment and its diagnosis and cure, we will pay \$50. The second-best letter will win \$25, and the writers of the five next-best will get \$5 each.

Gus and the technical editors of this magazine will judge the letters, and their decisions will be final. In case of a tie, each tying contestant will be awarded the prize tied for.

Address your letters to Gus Wilson, in care of POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, N. Y. Letters must be mailed before midnight on December 15, 1939, when the contest closes. No entries will be returned, and all will become the property of POPULAR SCIENCE MONTHLY.

to take a look in at the Fair today."

"So I am," Gus told him. "I'm just starting. What's the matter, Doc? You look sort of worried."

"Well," the doctor said, "I don't want to bother you about it on your day off, but these brakes of mine still are a long way from being right. They worked well enough for a while after you fixed them yesterday afternoon, but this morning they're so bad again that I'm afraid to drive with them."

"There's something darned queer about those brakes," Gus said, "and I'm going to find out what it is. I thought I had it licked the first time you came in about them."

"I didn't have any more trouble for about a week," Dr. Marvin said.

"And then you had some more. Air in the lines again. Then the same thing again yesterday. Well, I'm going to find that trouble right now! You take my bus to make your calls this morning, Doc. By the time you get back from them I'll have your brakes fixed or I'll have blown out a couple of little gray cells trying!"

Dr. Marvin protested to no avail.

"I'll have plenty of time at the Fair," said Gus. "Every one tells me that the evening is

the best time to enjoy yourself over there."

Finally Dr. Marvin drove off in Gus's car, and Gus drove the doctor's car into the shop. While he was changing into overalls, Joe Clark came in. "Might have known it!" he exclaimed disgustedly. "By jiggers, you're the most provoking man I ever knew. I'll..."

"Don't stand there gassing, Joe," Gus told him. "I want to get these brakes fixed, and then be on my way."

Joe shrugged his shoulders helplessly and went back into the office. "Come on, Harry," Gus said to the grease monkey. "We're going to take this hydraulic system apart."

They took the system apart, but Gus couldn't find anything the matter with it. The cylinders and cups were in perfect condition, and there were no leaks. So they reassembled it, and found that the brakes worked perfectly.

"Which," Gus said, "means nothing at all. Each time I've worked on them, those brakes have seemed in perfect condition when I finished, but they went bad again. I'm going to take this bus out and drive it for a while and see what happens."

Gus was back within a half hour, and as soon as he drove into the shop Harry saw that he was good and sore. "Same damn thing over again!" he snapped as he got out. "Air in the lines, so the brakes can't release properly. By gosh, it's got me stumped!"

He took his pipe out of his pocket, and walked around the rear end of the car toward his workbench, in search of his tobacco. "What's this?" he said stopping. "The tail light is burning. I'll have to check that stop-light switch."

He raised the hood, and with a quick glance located the switch, mounted on the master cylinder of the hydraulic system. Harry, always anxious to be helpful, reached in to make certain that it was fastened securely in its place, and jerked his hand away with a yell of "Ouch!"

"What's the matter with you?" Gus said unsympathetically.

"I burnt my fingers!" Harry moaned. "Say, that blamed switch is red-hot!"

"Hot?" said Gus. He touched a forefinger to his tongue, and then to the switch. "So it is—and the cylinder is hot, too." He took off the cylinder's filler cap, peered in and saw that the brake fluid was bubbling. "First time I've ever seen that happen."

He took the switch off, checked it carefully, and found that sometimes it shorted.

"So that's the answer," he said. "See what's been happening, Harry? Sometimes that switch would short, and get so hot that it would heat up the metal around it so much that the fluid would boil. The boiling oil periodically (Continued on page 243)

THE HOME WORKSHOP

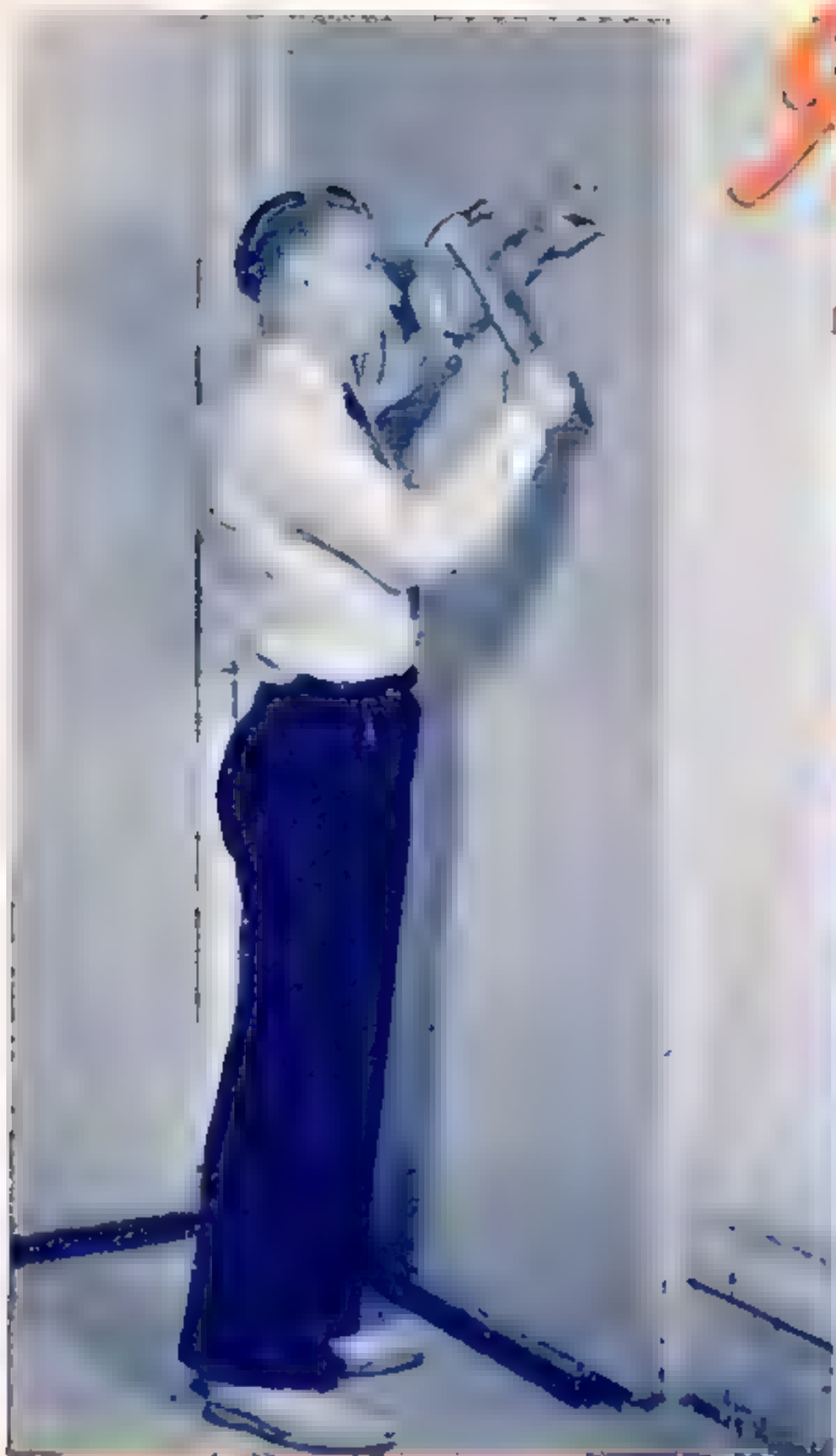


In This Issue... ICE BOAT, 1940 MODEL • PHOTO HINTS
EIGHT PAGES OF NEW CHRISTMAS-GIFT IDEAS
HOW MUCH OF NEW CHRISTMAS-GIFT IDEAS

It's the Finest

WHY YOU SHOULD START

PART 1 OF A NEW SERIES
FOR BEGINNERS



FITTING UP A PLACE TO WORK is the first step. Here Robert Jaacks, whom Mr. Love is helping to start a home workshop, is lining a corner of his double garage with three-ply fir wall board. He primed the plywood with paint before setting it up

WITH AN INITIAL OUTLAY of twenty-five dollars, he has put up and painted three sheets of wall board and built a simple bench. The top is a 2" by 12" plank, but the width has been increased by adding a tool tray. The bench is made more rigid by sheathing it with wall board. An inexpensive clamp-on vise is used, but will be replaced later with a permanent iron woodworker's vise. Drawers will be added to the bench. Some tools are racked on the backboard of the bench; others hang inside temporarily



Hobby of All!

A HOME WORKSHOP...AND HOW TO DO IT

ANYONE CAN BUILD UP A GOOD SHOP ON THE BUDGET SYSTEM

RELAXATION, pleasure, profit—these are the benefits offered by a home workshop. In this invaluable new series of articles, Mr. Love, who is an outstanding authority in this field, and one of his friends will illustrate the development of a woodworking shop. This shop is being started with an outlay of \$25 for tools and materials, and equipment will be added on a monthly budget of \$15. A bench has already been made as shown in one of the accompanying photographs and in the shop data file sheet on a following page. From month to month you will see the shop grow and in this way obtain suggestions to help you equip your own home workshop to suit your individuality and the kind of work you wish to do.

What is a home workshop?

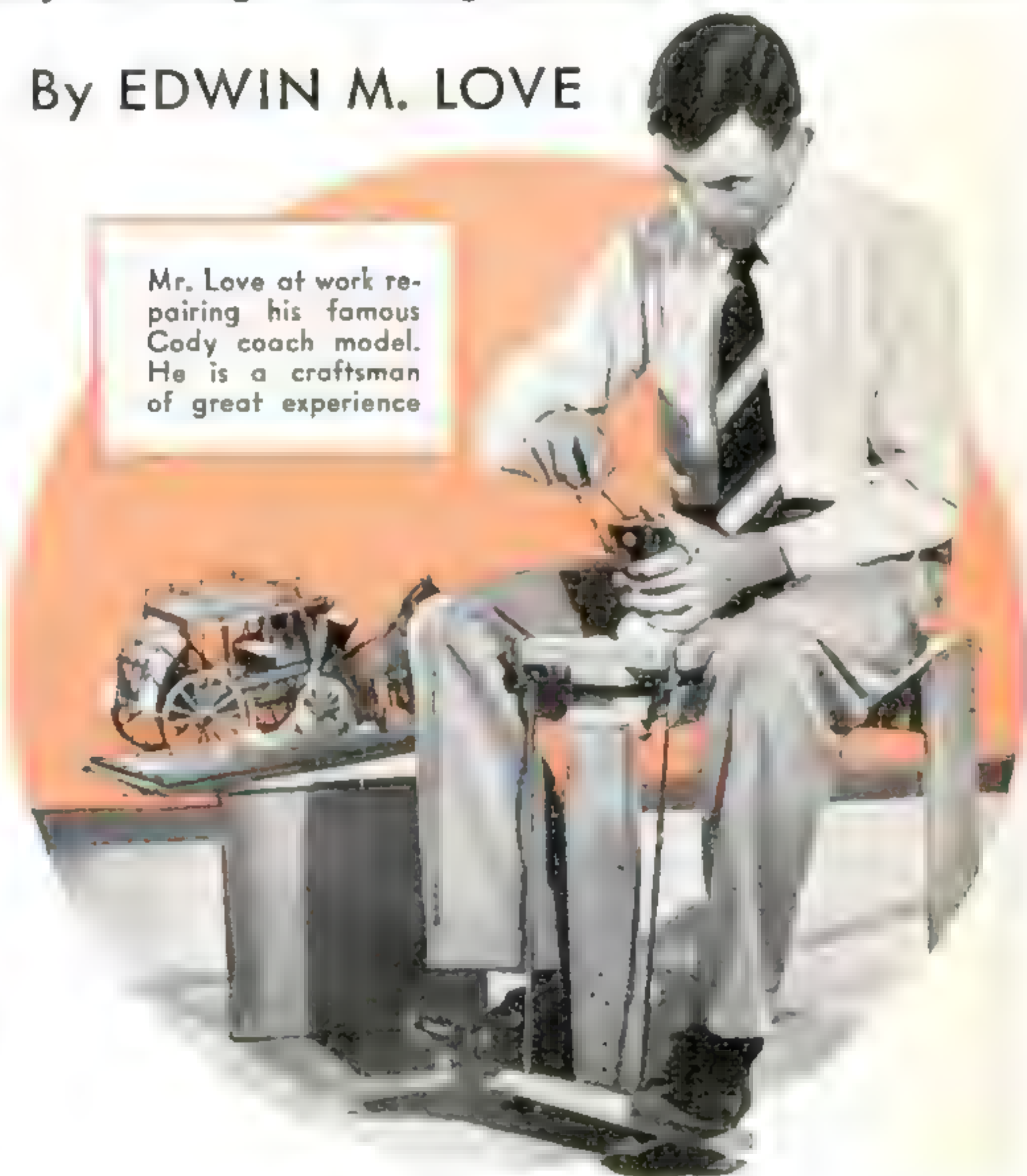
A HOME workshop is a place where a man can ride his hobby and indulge his creative bent. As he builds a cabinet, a ship model, or a desk set in copper, his business cares are forgotten, his worries vanish, and he relaxes in body and mind. He plays, but his play is more than a sport. He builds a thing of beauty and utility that is a visible token of patience, forethought, and skill. This experience in handwork gives the office man a better understanding of the craftsman's viewpoint; while practice in design and planning acquaints the physical worker with executive problems. Working together in the home shop, father and son are drawn into closer comradeship.

What can be done in a home workshop?

ALMOST any creative activity can be carried on. Woodworking is the most popular. There are home repairs to

make, garden trellises to build, tables and chairs, as well as decorative whatnots or whimsical toys, to construct. But metal machining, as in model locomotives and ex-

By EDWIN M. LOVE



Mr. Love at work repairing his famous Cody coach model. He is a craftsman of great experience



Jaacks pays a visit to Mr. Love's shop to ask some questions about a ship-model blueprint

perimental work, and ornamental projects in copper or brass are also much favored. Many other hobbies have their enthusiasts—leather work, puppetry, stagecraft, forging, jewel cutting, weaving, and pottery, to mention a few.

Is a home workshop expensive to equip?

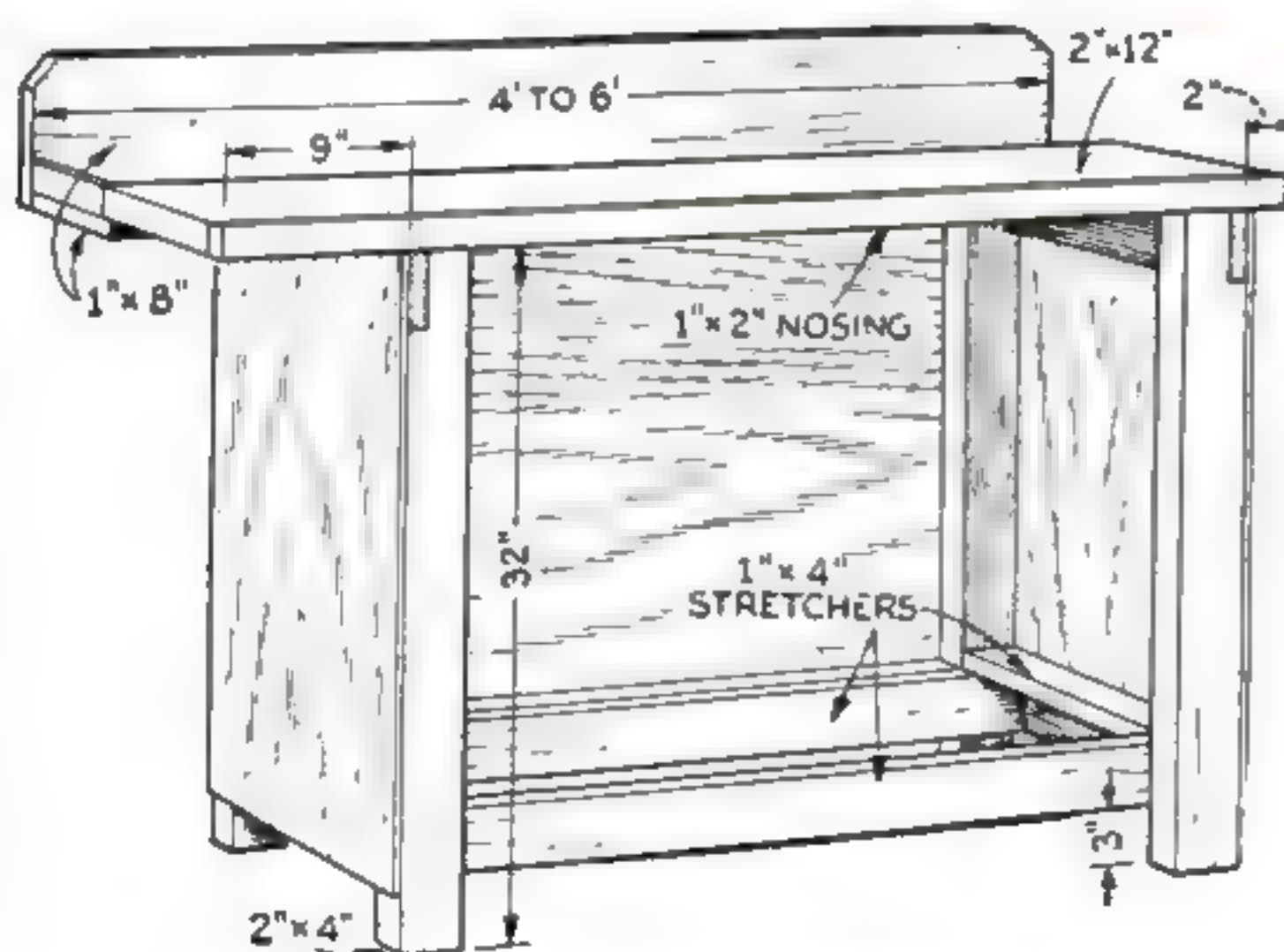
NO. The cost is moderate. Start with a small bench, such as the one shown on the accompanying shop data file sheet, and a few common hand tools of the type the average man already owns. As the need arises, add other equipment. One machine at a time can be bought, and this can be done on small monthly payments if necessary. Actually the cost of a well-equipped shop is generally less than that of a used automobile in fair condition.

Where can a shop be set up?

IN THE garage, basement, or a barn; even in an attic, bedroom, or a kitchen. A removable bench top can be clamped to the kitchen table, or a portable cabinet bench designed

BENCH FOR BEGINNERS

[WOODWORKING]



The top is a 2" by 12" plank smoothed on top and edges. Lap a board under the rear edge for a tool tray, and another on the back for a rack. Close the left end with a triangular block sloping inward toward the right. Notch upper stretchers to fit the top. Legs are attached with 3" iron corner braces. Cleats under the tray and behind the rear stretcher give nailing for the top and bottom of the $\frac{1}{4}$ " plywood sheathing. Any desired vise can be attached, and a hard-wood strip screwed across the end will serve as a planing stop. Drawers may be fitted inside.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

so that it can be pushed into a corner or closet. Sometimes a small, inexpensive lean-to may be built on the garage.

Renters change homes frequently. Isn't a shop hard to move?

NOT if properly planned. Keep tools in drawers or small cases, according to classification; and when moving time comes, fold the containers and nest them together in the van. Unpacking will be equally simple. Lighting equipment and wall racks can be standardized and made demountable.

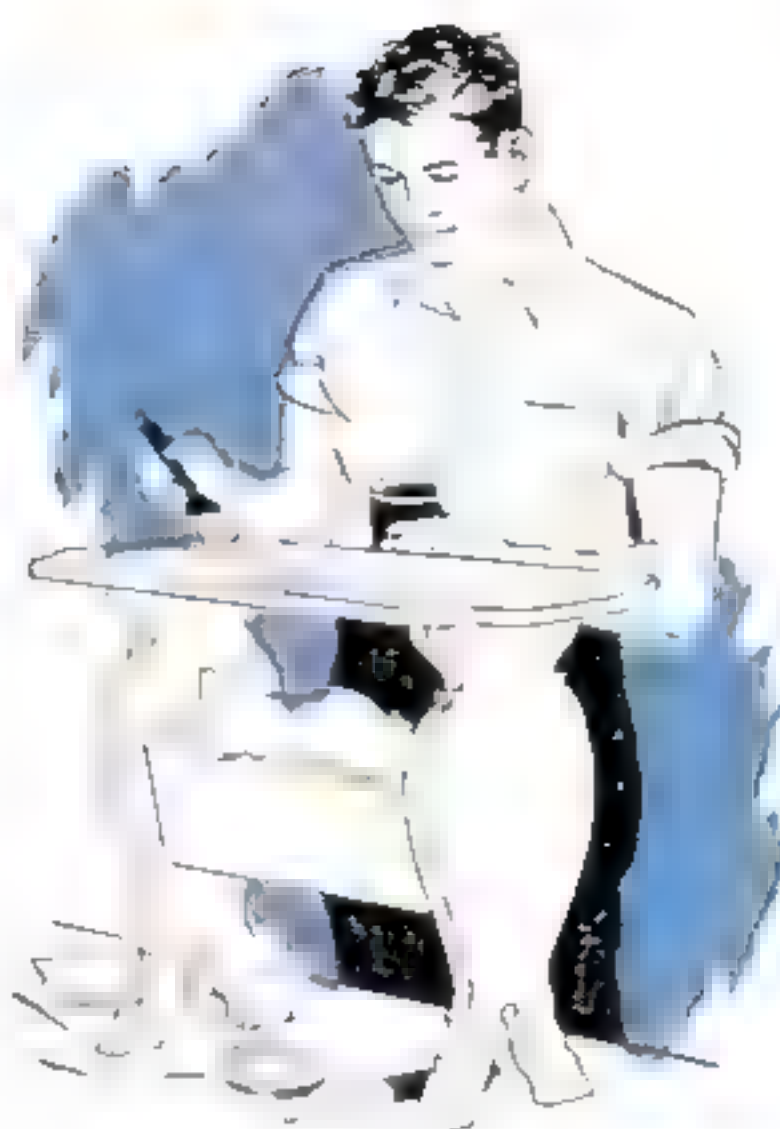
Garages and basements are deficient in windows. What about lighting?

AS THE home shop is mostly used at night, windows are not needed for light, which is an advantage, as equipment can be placed without reference to them, with racks near at hand. Individual lights, or lamps on swinging brackets, are easily contrived, and a small fan will aid in obtaining adequate ventilation. In cold weather install a gas heater, if necessary, or if building laws permit, use a small stove to burn chips and litter.

Incidentally, the fewer windows, the easier it is to solve the noise problem. Line the shop with wall board or any cheap sound-insulating material, even cardboard newspaper mats, and set machine and bench legs on rubber or in cups of sawdust. Little noise will then reach the outside.

What materials are worked in home shops, and what do they cost?

WOODS can be purchased or ordered at any lumberyard and cost from a few cents to a dollar a board foot (1" by 12" by 12"). Good paints cost 30 cents and up a half pint. A little arithmetic will show that furniture built of excellent materials need not be costly. Aluminum and copper tubes and sheets cost about 90 and 50 cents a pound respectively at a tin shop. Local costs of plastics, leathers, art materials, and the like vary, but can be found easily



enough by inquiring at stores and shops. Many usable materials can be found at wrecking yards, in scrap bins and attics, and even at second-hand stores. Hard-to-get items may be obtained from specialized mail-order houses that advertise in magazines. Their catalogues list innumerable craftwork materials, veneers, rare woods, hardware, fittings, special tools, and finishes.

Is it worth while for an unhandy man to have a shop?

BY ALL means. Try out various hobbies, and one that suits will be found. Practice develops interest, skill, ingenuity, and all-round ability. The man who hasn't aptitude in some shopwork is almost nonexistent.

Can project plans be bought?

YES. This magazine, for example, offers excellent plans at low prices. There are dozens of interesting projects of the type that can be built in one evening, and of course, any number that need more time. The latter call for greater skill and have a continued and growing interest, like an exciting serial story. In addition, various construction kits for building models, boats, decorative metal projects, and even furniture, are offered in various forms.

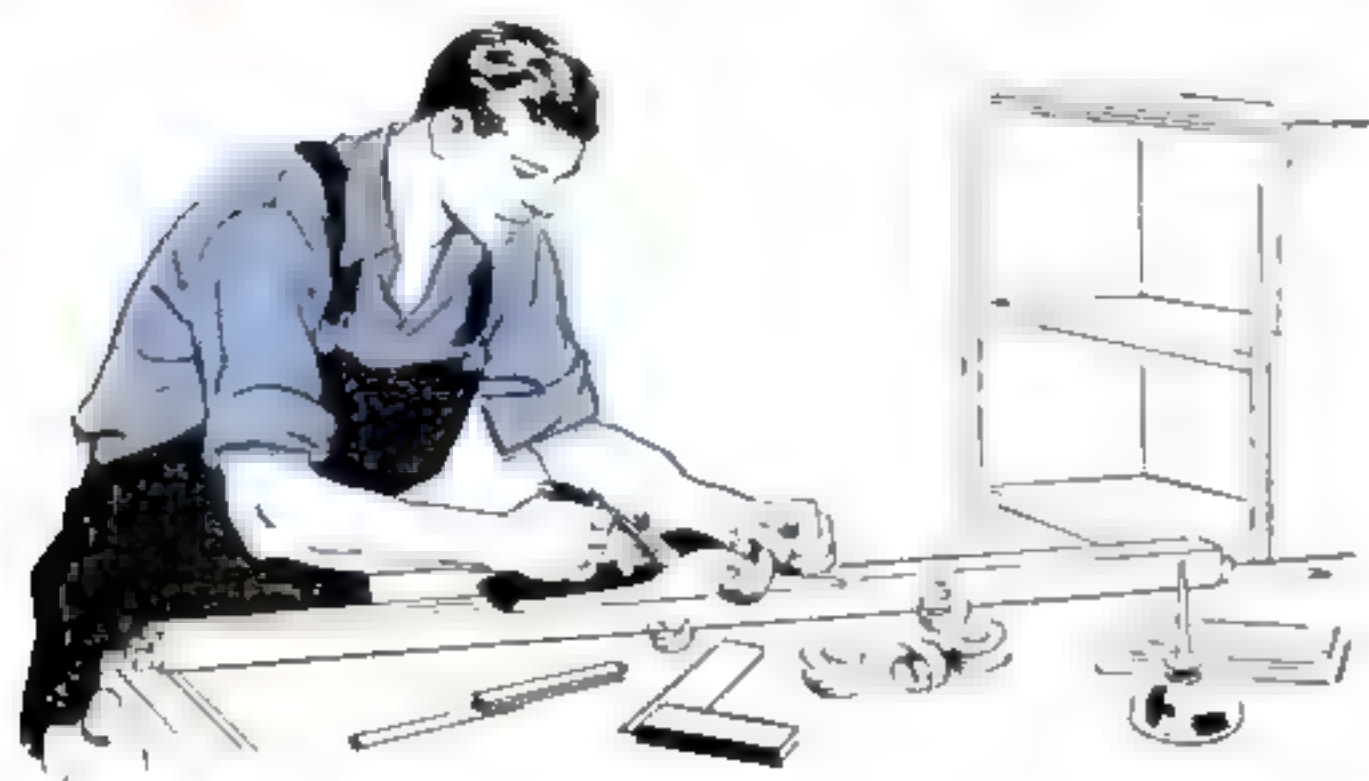
Can the average man make presentable original designs for his projects?

HE CAN easily learn to. Good design is largely dependent on good proportion; and two or three simple rules, applied with common sense, will take care of most of the common problems encountered in planning original projects. There are excellent books on the subject.

Can the home workshop be used for community betterment?

HUNDREDS of home workshop clubs and individuals make toys to distribute among poor children, build bird houses, and construct equipment for Boy Scouts, small local libraries, churches, and other organizations. And there is no reason why larger projects could not be undertaken.

(TO BE CONTINUED)



ICE BOAT...1940

SPEEDY, stable, and spinproof, this new ice boat *Mercury* embodies the latest improvements in design. It is a four-runner craft with long, springy fore-and-aft runner planks. These planks assure resiliency and comfortable riding qualities, yet keep the runners in perfect alignment. A steering bar traverses the cockpit so the pilot can steer without chang-

ing positions with passengers in the boat.

Mercury is 18' long and 9' 2" wide, with a cockpit large enough to hold five or six persons. The sail area of 125 square feet makes

LIST OF MATERIALS

LUMBER

Runner planks: 6 pc. 1" by 8" by 18' 3" spruce.
Tapered blocks: 2 pc. 1½" by 8" by 18" oak; 4 pc. 1¼" by 8" by 9" oak.
Crosspieces: 2 pc. 1¼" by 2½" by 9' 2" oak.
Braces: 2 pc. 1¼" by 2½" by 4' oak.
Center plank: 2" by 8" by 8' white oak.
Cockpit floor: 2 pc. ½" by 43" by 6' plywood or pressed composition wood.
Back rest: 1 pc. ½" by 8" by 7' white oak.
Back-rest supports: 6 pc. ¾" by 3" by 10" white oak.
Dashboard: 2 pc. ½" by 8" by 43" white oak.
Runner chocks: 4 pc. 1¼" by 6" by 4' white oak.
Runner fenders: 2 pc. 1½" by 2' 0" half-round oak.
Mast: 2 pc. 1½" by 6" by 24' spruce.
Boom: 2 pc. 1" by 3½" by 12' spruce.
Boom jaws: 2 pc. ¾" by 1½" by 15" white oak.
Wooden stays (optional): 4 pc. 1" by 2" by 16' spruce.
Tiller bar: 1¼" by 2½" by 8' 6".
Tiller brace: 1" by 2" by 7'.

METAL PARTS

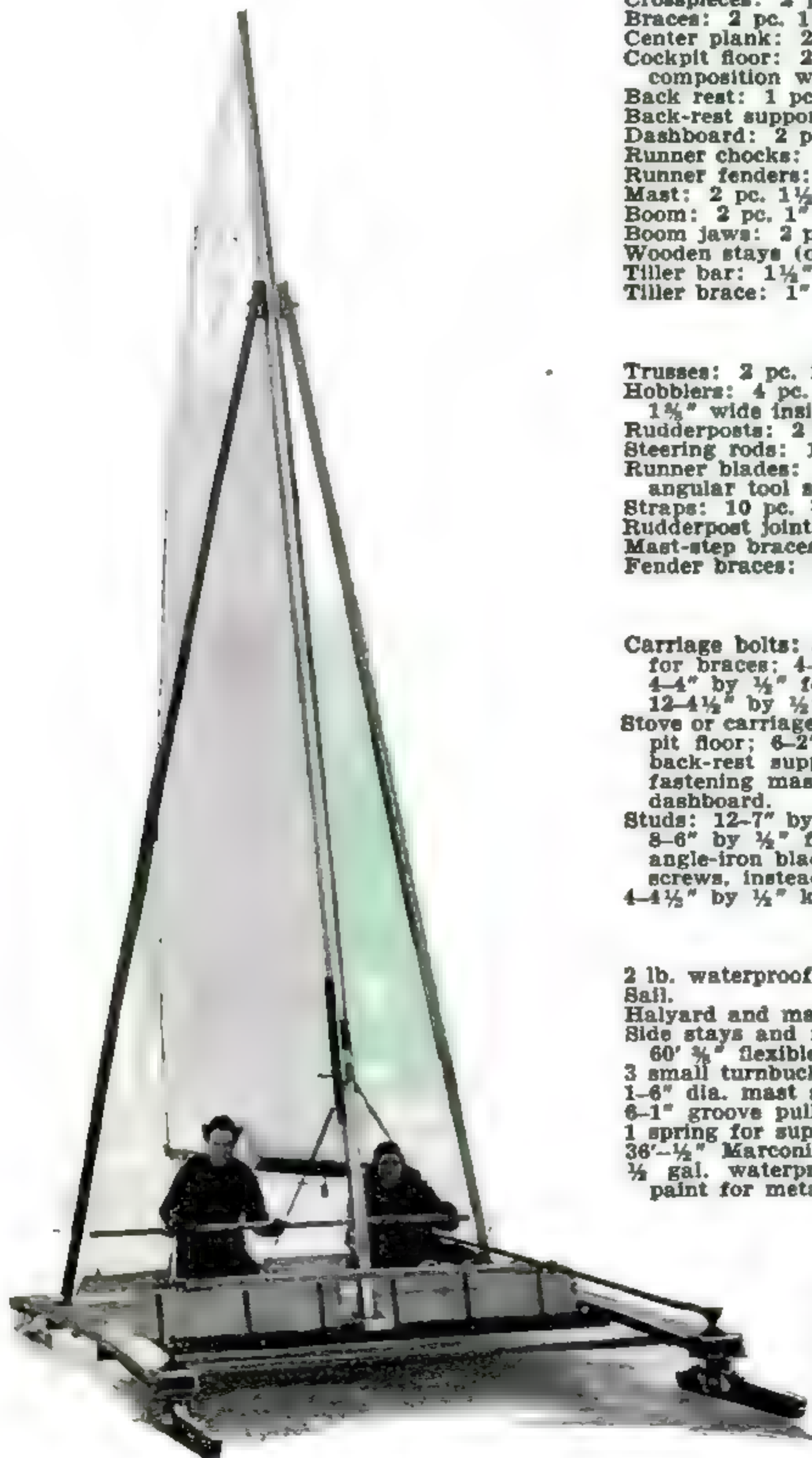
Trusses: 2 pc. 2" by 3" by 9' 2" angle iron.
Hobblers: 4 pc. 3" by 4" angle iron 12" long; 2 channels 1¼" wide inside by 4" deep by 5" long.
Rudderposts: 2 pc. ¾" dia. 12" long.
Steering rods: 1" tubing. 2 pc. 8' long.
Runner blades: 4 pc. 1" by 1" angle iron or 60-deg. triangular tool steel, 42" long.
Straps: 10 pc. ¼" by 1" by 8".
Rudderpost joints: 2 Chevrolet drive-shaft universal joints.
Mast-step braces: 2 pc. 2" by 5" angle iron 3" wide.
Fender braces: 4 angles 1½" by 3" by 1" wide.

FASTENINGS

Carriage bolts: 8-4½" by ½" for trusses; 12-5" by ½" for braces; 4-3½" by ½" for fastening center plank; 4-4" by ½" for fastening rear braces to center plank; 12-4½" by ½" for attaching hobblers.
Stove or carriage bolts: 28-1¼" by ¾" for fastening cockpit floor; 6-2" by ¾" and 6-3" by ¾" for attaching back-rest support; 2-3" by ¾" and 2-4" by ¾" for fastening mast; 18-1" by ¼" (with lock washers) for dashboard.
Studs: 12-7" by ½" for attaching triangular steel blades; 8-6" by ½" for attaching triangular steel blades. (If angle-iron blades are used, ½ gross No. 8-¾" flathead screws, instead of studs.)
4-4½" by ½" kingbolts for runner pivots.

MISCELLANEOUS

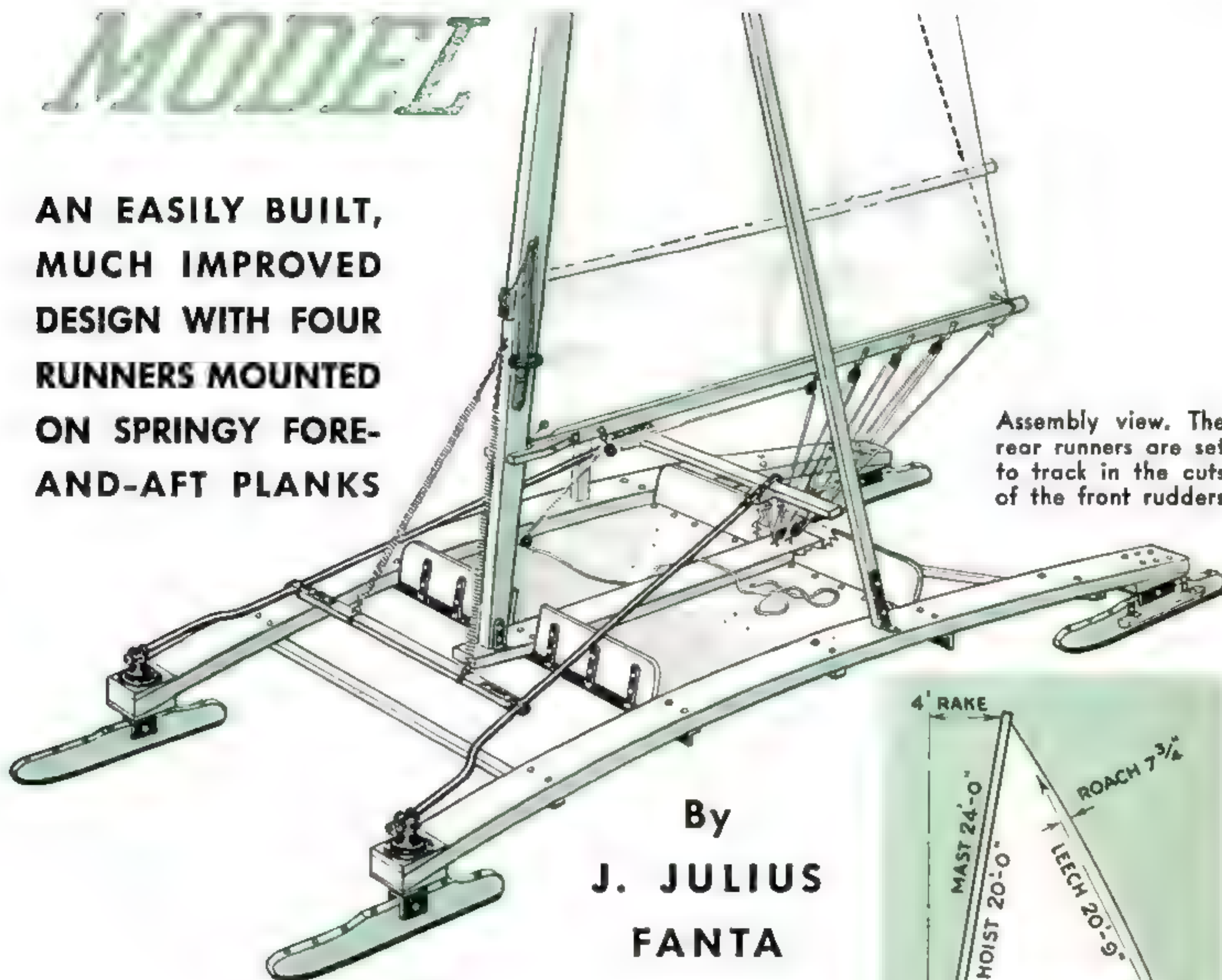
2 lb. waterproof casein glue.
Sail.
Halyard and mainsheet: ½" Manila rope, 75' required.
Side stays and forestay (if wooden stays are not used): 60' ¾" flexible cable.
3 small turnbuckles.
1-6" dia. mast sheave.
6-1" groove pulleys; 2-1" double pulleys.
1 spring for supporting steering gear.
36'-½" Marconi track, if substituted for grooved track.
½ gal. waterproof spar varnish and ½ pt. aluminum paint for metal parts.



The unusual design of this ice boat makes capsizing practically impossible. The roomy cockpit can accommodate five or six

MODEL

**AN EASILY BUILT,
MUCH IMPROVED
DESIGN WITH FOUR
RUNNERS MOUNTED
ON SPRINGY FORE-
AND-AFT PLANKS**



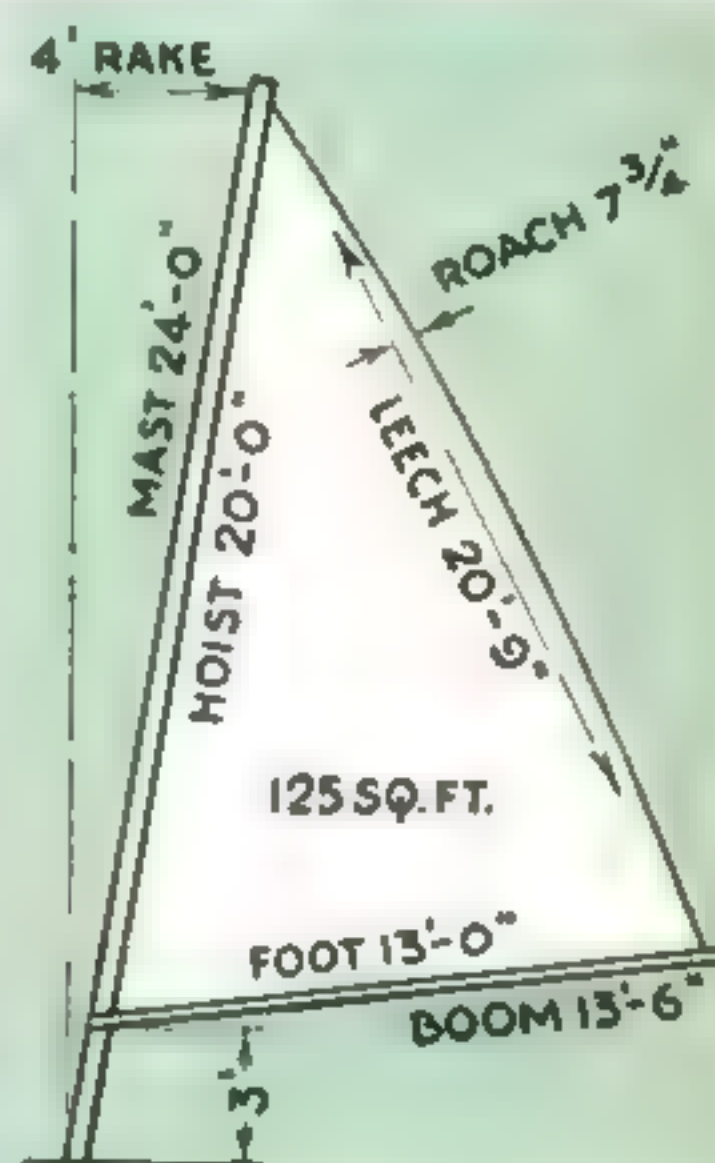
By
**J. JULIUS
FANTA**

the boat fast in light winds, and it can hold its own with racing craft capable of from 60 to 65 miles an hour.

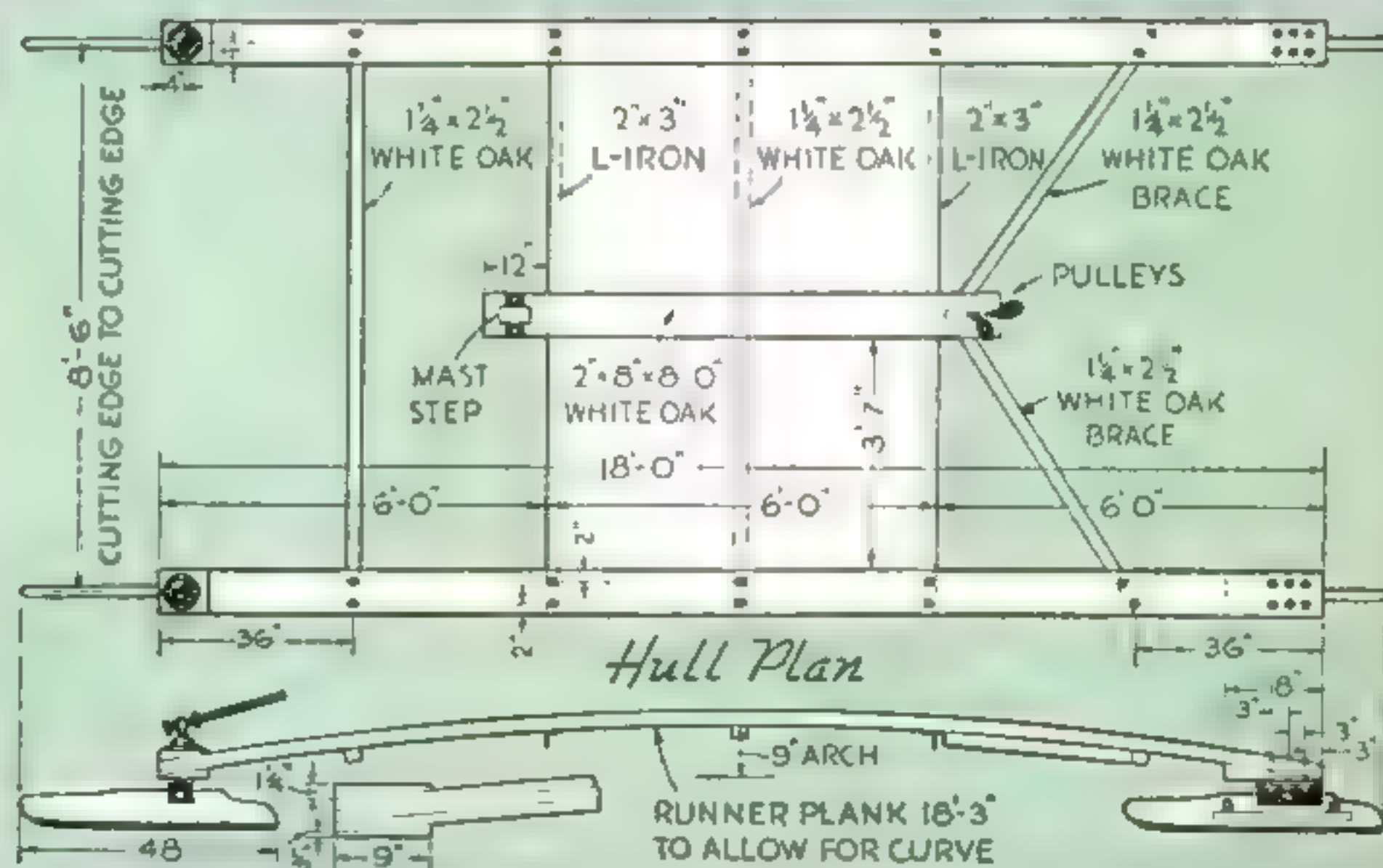
The original ice boat was constructed by Walter Winding, of Milwaukee, Wisc., at an estimated cost of \$90 for all materials, including a professionally made sail. The work required about 100 hours.

Select Sitka spruce is used for the runner planks, each of which is laminated by gluing up three boards of the size given in the list of materials. For this purpose use only waterproof casein glue. As soon as each plank is glued to the proper thickness, support the ends on sawhorses and weight the center until the plank bends down 9". Then clamp the glued boards in numerous places with C-clamps or hand screws. Do not remove the clamps for at least twenty-four hours; then any glue that has oozed out can be removed with a chisel.

To level off the ends
and provide square sup-



With this sail, the boat is fast even in light winds



A top view of the hull and side view of the runner plank and runners



The stability of the boat is obvious from this rear view. Note pulleys to keep mainsheet from fouling

ports for the rudderpost fittings forward and the hobbler bolts aft, it is necessary to glue six tapered wooden pieces in place as shown. Then saw the planks to length and plane the edges thoroughly.

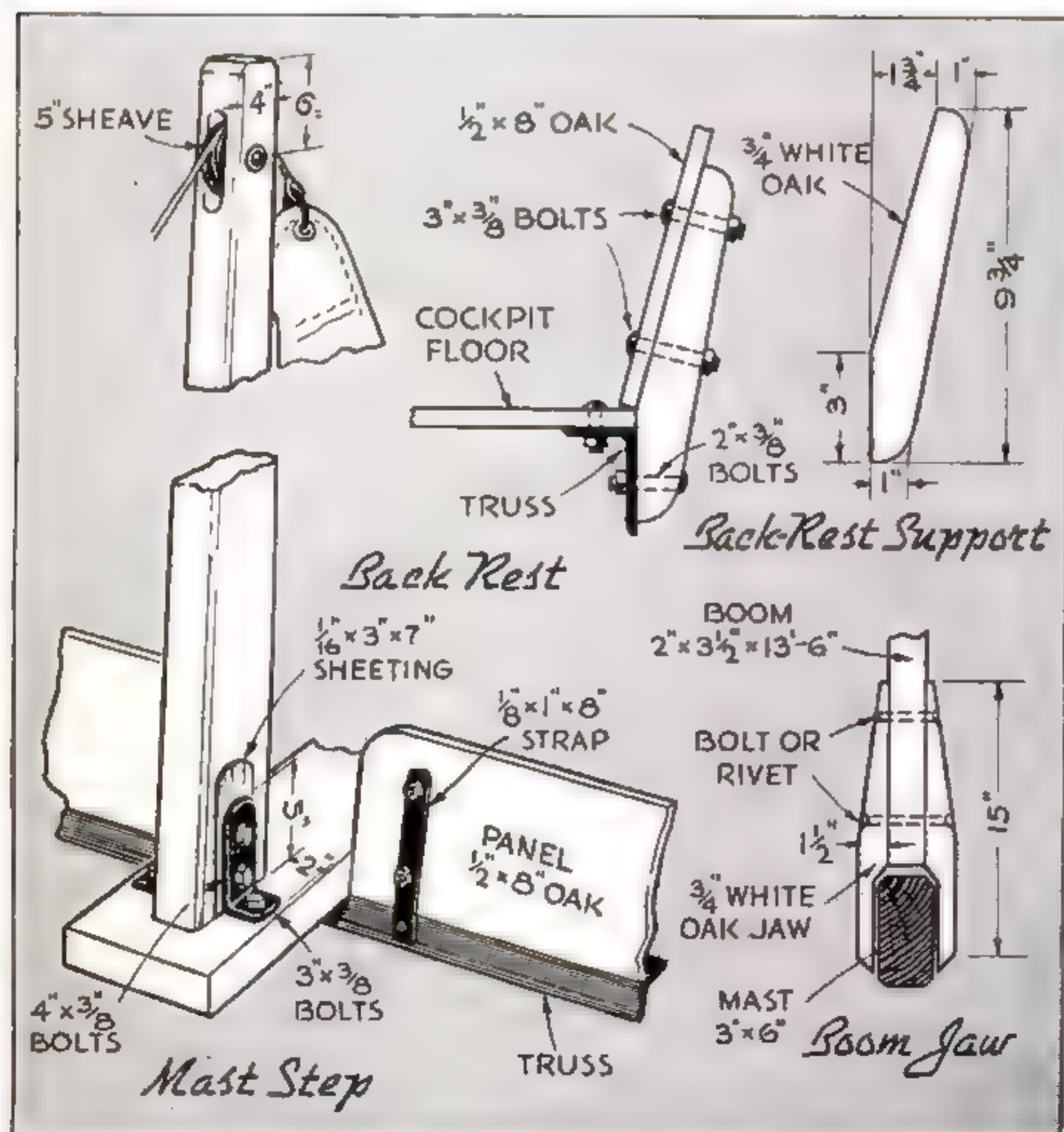
At the fore ends of the planks, drill $\frac{3}{4}$ " holes for the rudderposts 4" from the butt end, and $\frac{1}{2}$ " holes for the hobbler bolts of the fixed runners at the after ends.

Now the 2" by 3" by 9'2" angle-iron beams are bolted 6' from the ends of each plank. Drill two $\frac{1}{2}$ " holes at the ends of these beams on the 2" side. The holes should be 2" and 6" from the ends. Also drill holes in the planks to correspond, and fasten the beams with $4\frac{1}{2}$ " by $\frac{1}{2}$ " carriage bolts.

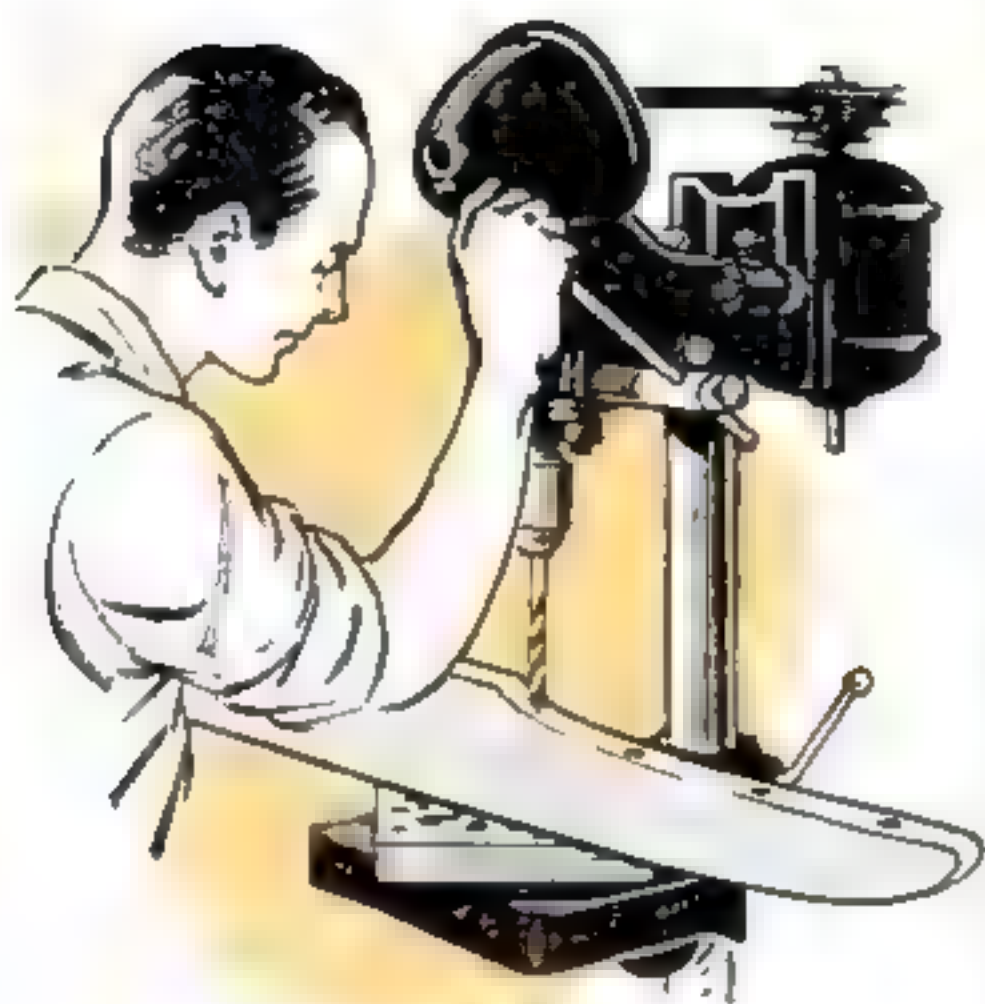
Halfway between the iron beams, a $1\frac{1}{4}$ " by $2\frac{1}{2}$ " oak crosspiece is bolted with 5" by $\frac{1}{2}$ " carriage bolts. A similar crosspiece is bolted to the planks 3' from the fore ends.

A fore-and-aft center plank of 2" by 8" by 8' white oak spans the traversing iron beams as shown. It is fastened with two $3\frac{1}{2}$ " by $\frac{1}{2}$ " carriage bolts to each beam. Fit $1\frac{1}{4}$ " by $2\frac{1}{2}$ " oak braces between the center plank and runner planks, crossing the latter 3' from the rear ends, and fasten with $\frac{1}{2}$ " carriage bolts.

Two sheets of $\frac{1}{2}$ " ply-



How the mast is stepped, and details of boom jaw and back rest

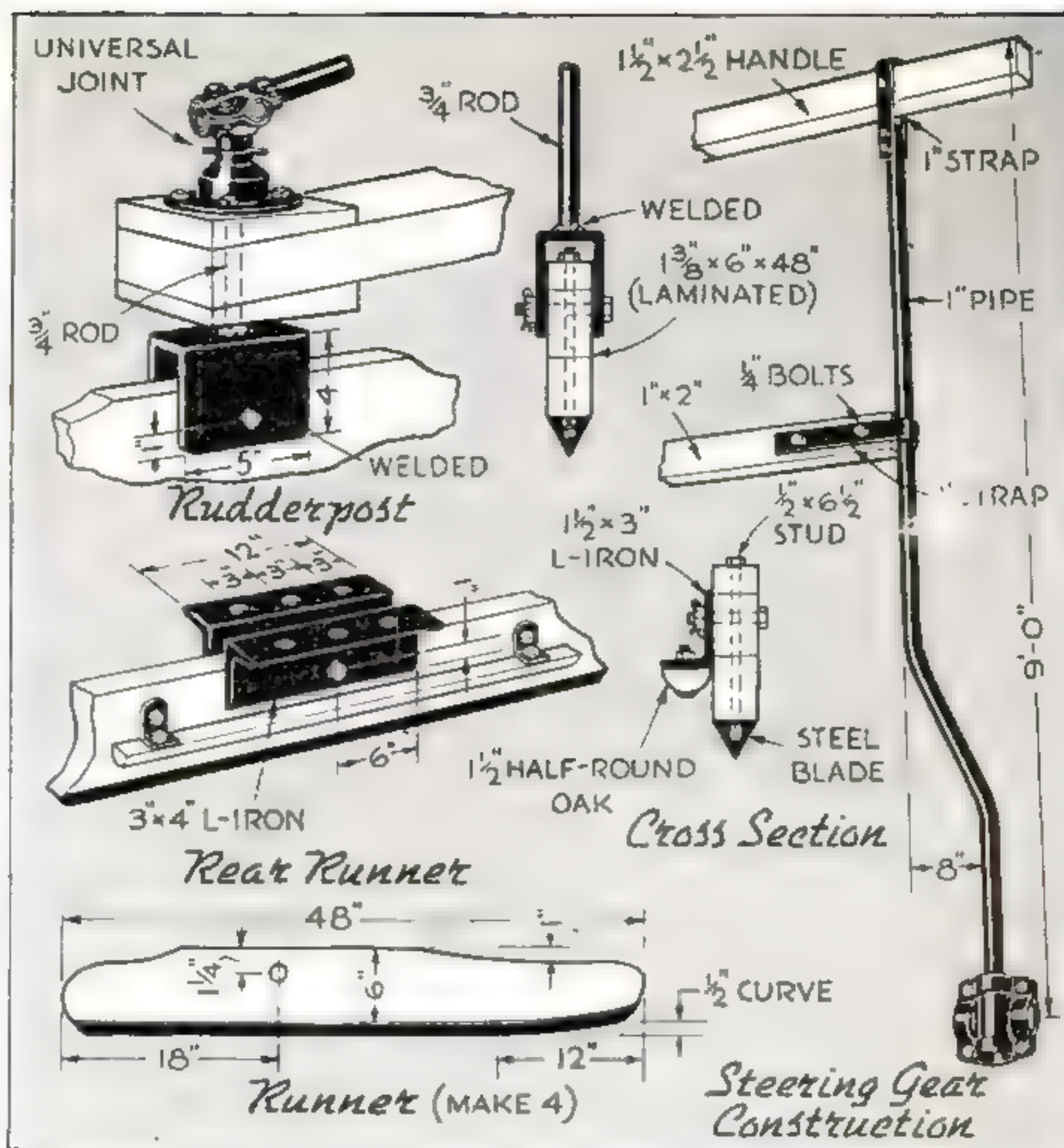


wood or pressed composition wood, 43" by 72", are fitted between the center plank and the runner planks for the cockpit floor. The edges of the floor should be flush with the facing of the angle-iron trusses. Use $1\frac{1}{4}$ " by $\frac{3}{8}$ " stove or carriage bolts, with lock washers, to secure the flooring to the trusses, and space the bolts 6" apart.

A back rest of $\frac{1}{2}$ " by 8" oak is mortised for the center plank and fitted between the runner planks. It is supported in a tilted position by six supports of white oak, as indicated. Each support is bolted to the iron truss with 2" by $\frac{3}{8}$ " carriage bolts and to the back rest with 3" by $\frac{3}{8}$ " bolts, with the heads inside.

The front panel of the cockpit consists of two pieces of $\frac{1}{2}$ " by 8" by 43" oak, to allow an opening for mast adjustment. These are held with $\frac{1}{8}$ " by 1" by 8" strap iron, secured with 1" by $\frac{1}{4}$ " bolts and lock washers.

Prepare the rear hobbler next. These are four pieces of 3" by 4" angle iron in 12" lengths. They are drilled as specified in the sketch marked "rear runner" for bolt-

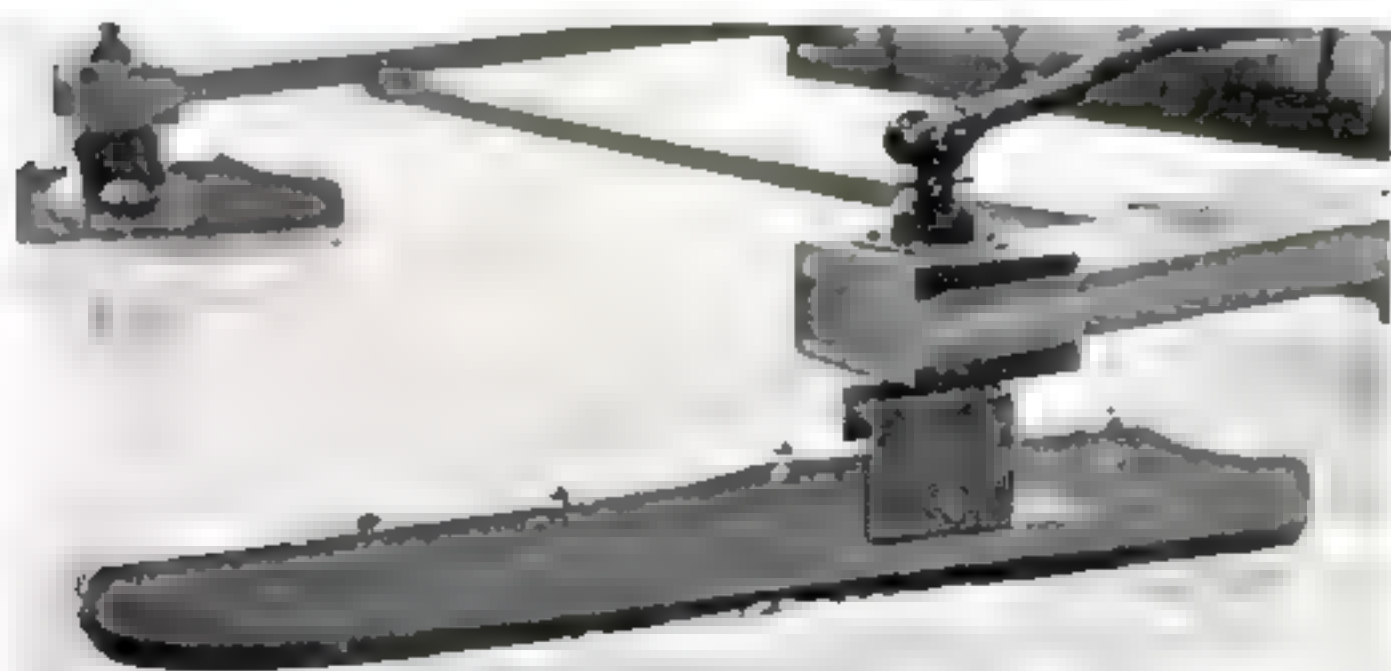


Method of making and mounting runners, and steering-gear details

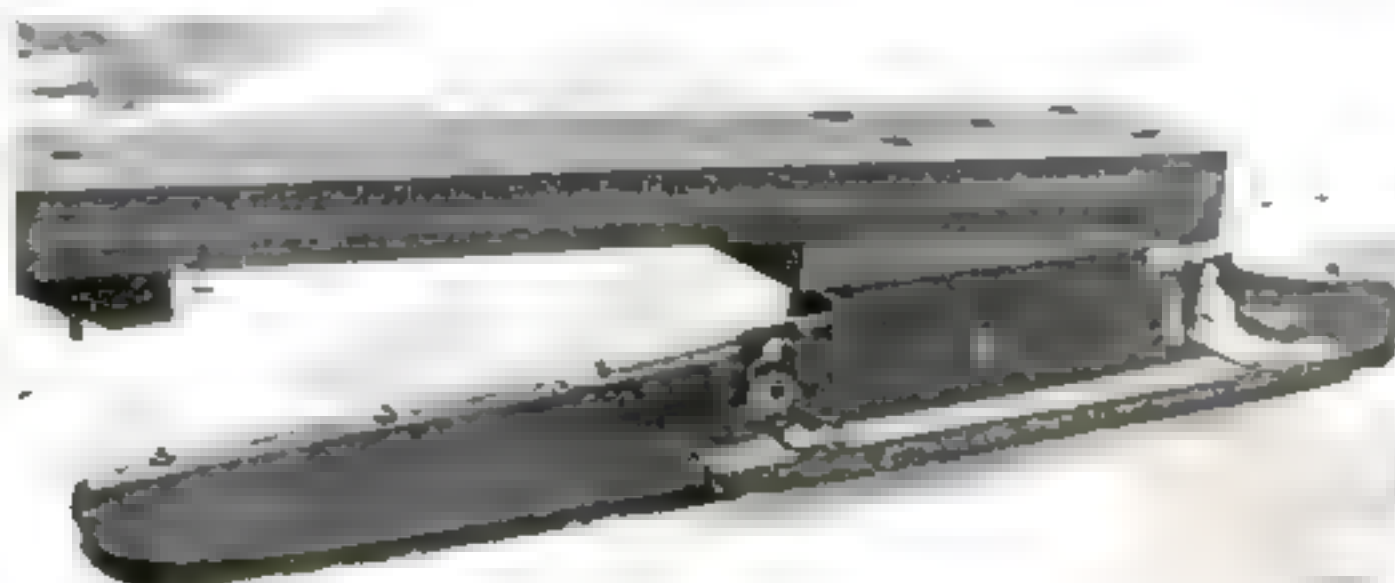
ing them to the runner planks with $4\frac{1}{2}$ " by $\frac{1}{2}$ " bolts, with space between each pair for inserting the runners.

Care should be taken in drilling the runner plank for the hobbler bolts so that the distance between each pair of angle irons is exactly $1\frac{3}{8}$ " throughout, otherwise the runner will not fit properly. Leave the bolts slightly loose for later adjustment of the rear runners.

The rudderposts call for a little inexpensive welding. Rods $\frac{3}{4}$ " in diameter are welded to the center of the tops of channel-iron pieces, as shown, which form hobbler for the rudders. Steering rods of 1" pipe, with an 8" S-curve in each, are connected to the rudderposts with old Chevrolet drive-shaft universal joints. A wooden crosspiece (its length will vary according to the S-curves, but is about 7') holds the steering alignment true and is secured to the steer-



A close-up of one of the front rudders, showing the hobbler and the steering connection above. At right, a similar view of one of the rear runners





The steering bar traverses the cockpit so the pilot can steer without having to change his position

ing rods with 1" metal straps. The tiller bar is fastened likewise.

All runners are similar in size, shape, and construction. Precision in making runners contributes to the speed in racing. Warping is prevented by laminating the runner chocks, which are made of $1\frac{3}{8}$ " by 6" white oak. Cut each chock lengthwise into 1" strips and reverse the ends of alternating strips of each chock. Then glue the strips and clamp them until dry.

The bottom edges of the chocks should have $\frac{1}{2}$ " curves as indicated so that runners will be rocker-shaped for easier maneuvering. Angle-iron blades may be fitted by beveling both sides of each chock; and they are then fastened with 1" flathead screws. For racing purposes, however, high-grade triangular tool-steel blades are recommended. Drill five $\frac{1}{2}$ " holes through the chock for stud bolts, and $\frac{1}{2}$ " deep into the tops of the triangular blades so they may be tapped for the studs. The blades assume the proper curve when drawn against the chocks by tightening the studs. To the outsides of the rear runners are fastened $1\frac{1}{2}$ " half-round oak fenders with $\frac{1}{4}$ " angle iron, as shown. All runners pivot in the hobbler bolts on $\frac{1}{2}$ " kingbolts and are cotter-pinned.

The mast is made by gluing together two pieces of $1\frac{1}{2}$ " by 6" spruce, 24' long, after

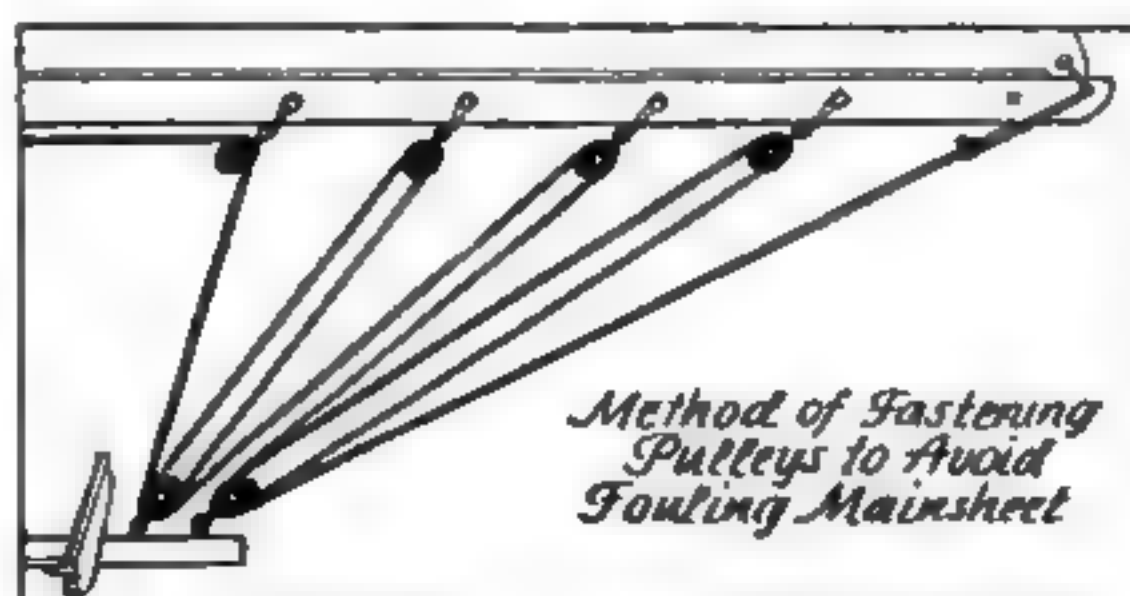
grooving each half near the top, as indicated, for the sheave used in hoisting the sail with a boltrope. The mast may be tapered at the bottom to 4" wide, if desired. The step is fastened to the center timber as shown. The mast may be braced with wooden side stays in the way illustrated or with conventional $\frac{1}{4}$ " cable and turnbuckles, eye-bolted to the runner planks.

Light springs are fastened to the mast to suspend the steering gear for the convenience of the pilot. Single-sheave blocks are lashed in a single row to the boom in order to avoid fouling the mainsheet. The mainsheet runs forward to a pulley at the mast for ease in trimming sail.

Sandpaper the hull, runners, mast, and boom thoroughly before applying three coats of high-grade waterproof spar varnish. Each coat should be dry and lightly sandpapered before adding another coat.

The alignment of the runners must be accurately checked to get speed. The fixed runners aft must be absolutely parallel. Check this with a large square and also by measuring the distance between the

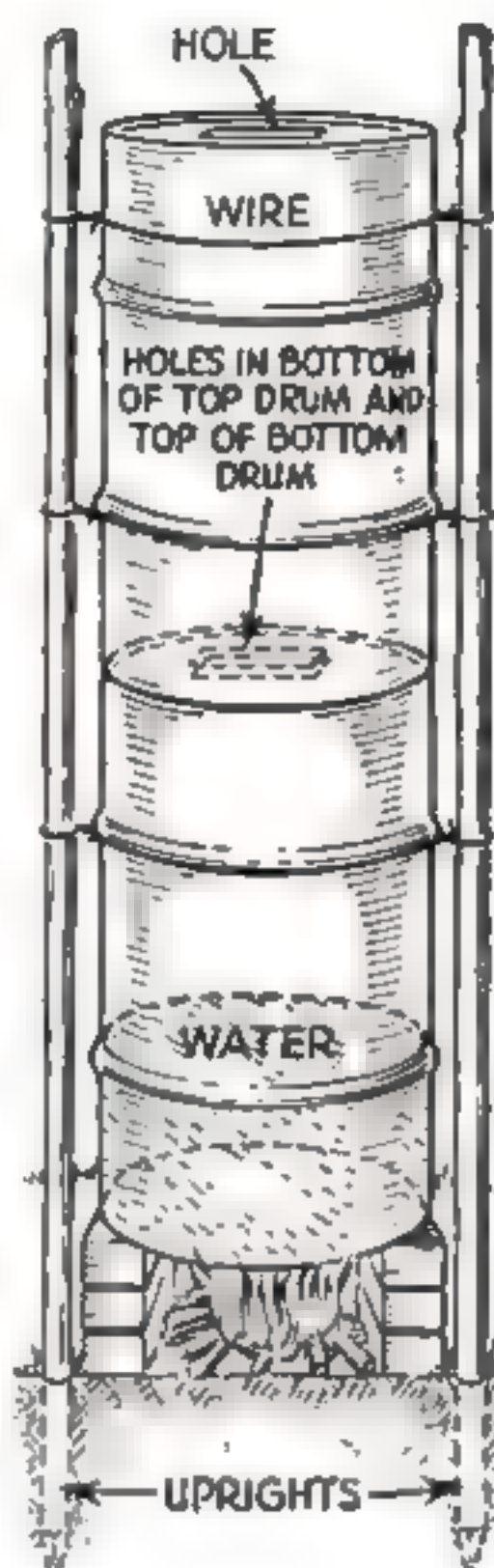
cutting edges with a batten. If out of line, loosen the hobbler bolts and twist the runners accordingly. The forward runners are aligned by adjusting the crossbars of the steering gear, or by loosening the universal joints.





Steaming a long plank so it can be bent for the runner of a motor sled

Steam Box for Special Work Built from Two Oil Drums

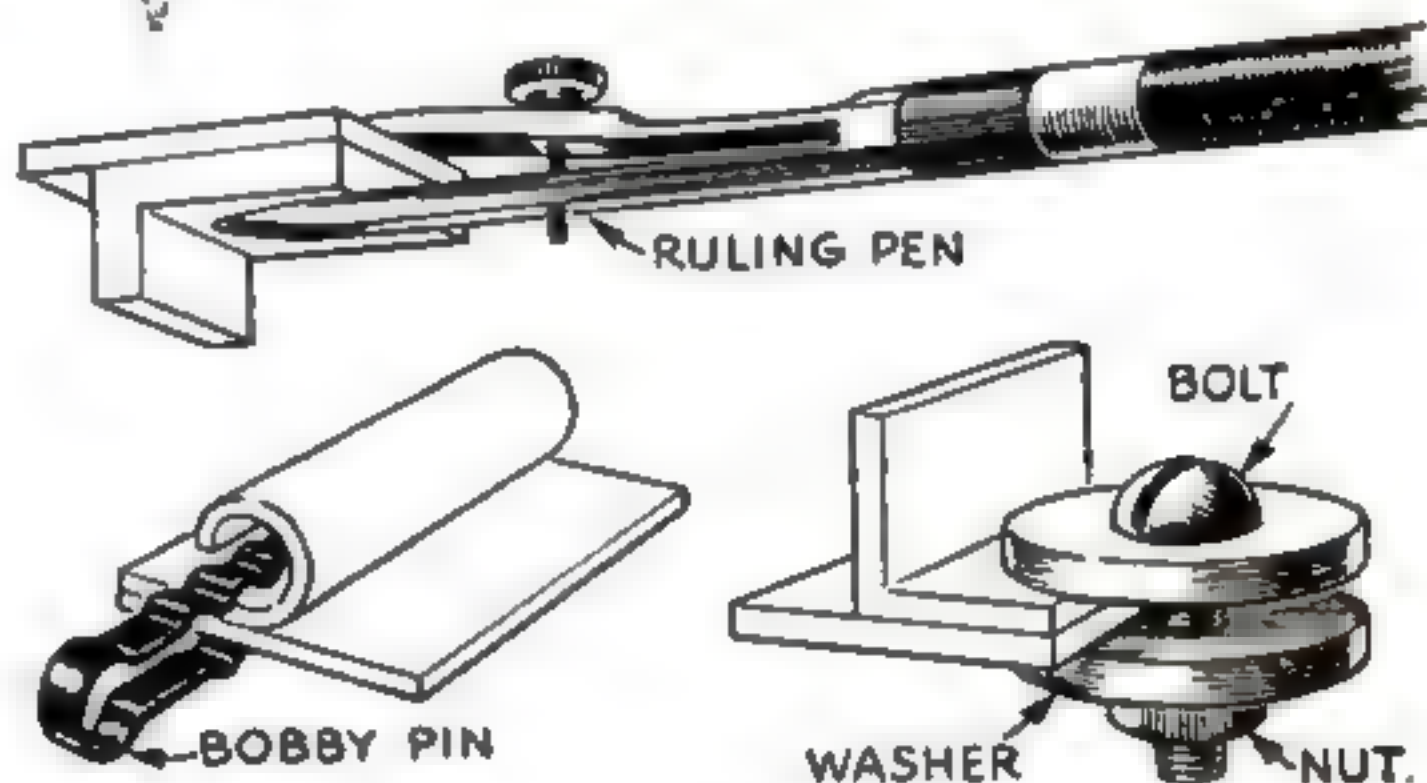


FACED with the problem of bending long wooden runners for a motor sled he was making, one amateur mechanic constructed a steam box from two oil barrels, placed one on top of the other, as illustrated at the left. A rectangular opening was cut in the top and bottom of the upper drum and in the top of the lower one to permit the wood to go through into the bottom barrel. The opening was made only slightly larger than the wood.

The barrels were propped up with bricks and stones so that a fire could be built underneath, and fastened to the upright poles with wire. The lower barrel was partly filled with water. Sacking was wrapped around the work at the top so most of the steam would be retained within the drums.—JOHN G. ROBERTS.

Clamps for Model Making

SMALL clamps for model making are easily improvised from a number of commonplace objects. Spring wooden clothespins with the jaws shaped as necessary and steel paper clips are frequently used. A discarded ruling pen is excellent for very small work, as are bobby pins and small bolts with large washers.—S. J. GANCHER.

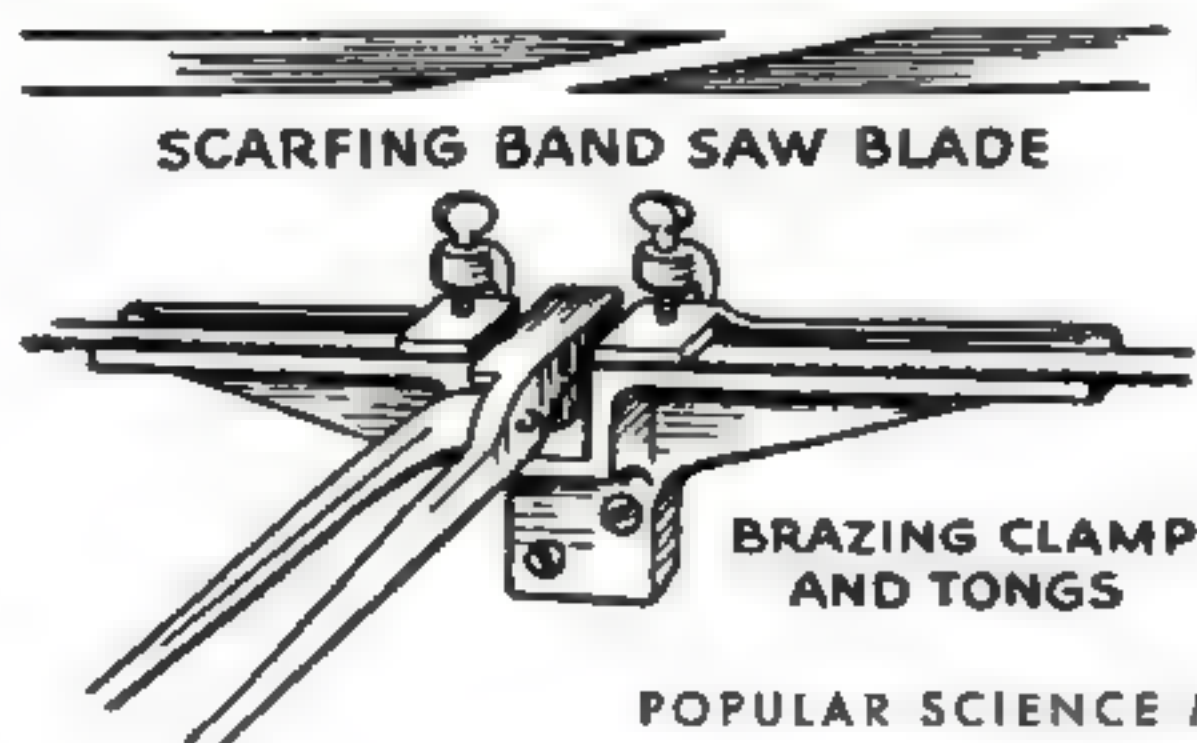


BRAZING NARROW BAND SAWS

[WOODWORKING]

Square broken ends of blade and file bevel on outside of one and inside of the other. Band saws should have an even number of teeth. Make the bevel $\frac{3}{8}$ " long on $\frac{1}{2}$ " or narrower blades. Clamp ends in brazing clamp so that backs are in line. Cover the filed surfaces and a piece of silver solder, the size of the joint, with a paste of borax mixed with water. Place the solder in the joint and melt it with a pair of red-hot blacksmith's tongs or with a blowtorch. In

the latter case, clamp the joint the instant the solder melts and the torch is removed. To prevent breakage, reheat the joint until it turns a straw color. File off excess solder.



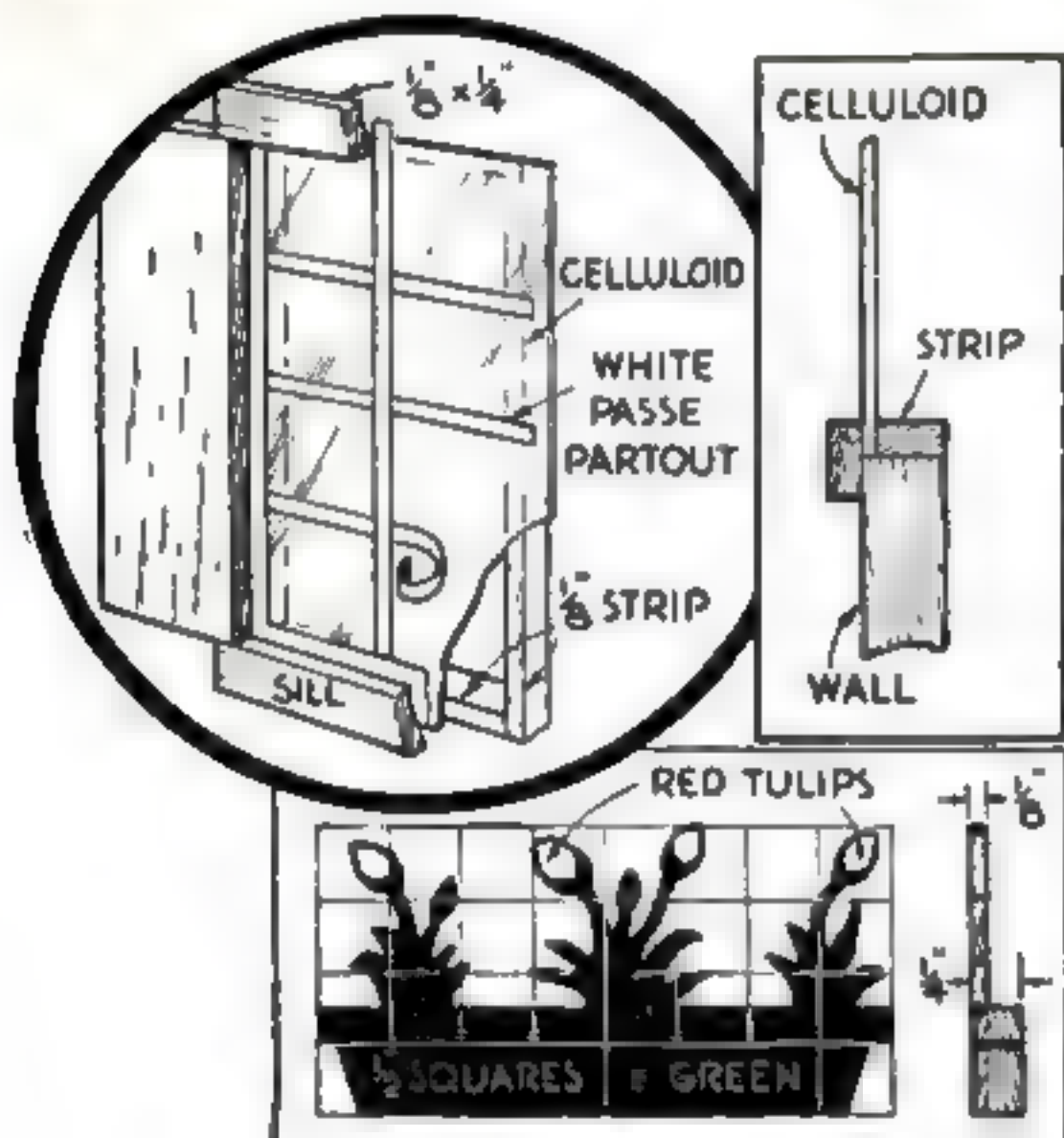
POPULAR SCIENCE MONTHLY SHOP DATA FILE

A CHARMING LITTLE CAPE COD



DESIGNED in the style of a picturesque little Cape Cod cottage, this doll house is an admirable Christmas present.

Quarter-inch plywood is used throughout, with the exception of a thicker base, and the whole is assembled with casein glue and brads. Assemble the ends with the partitions, then add the ceiling, and finally the roof. The front and rear walls are separate units and may be removed by pulling them out at the bottom or sliding them endwise.

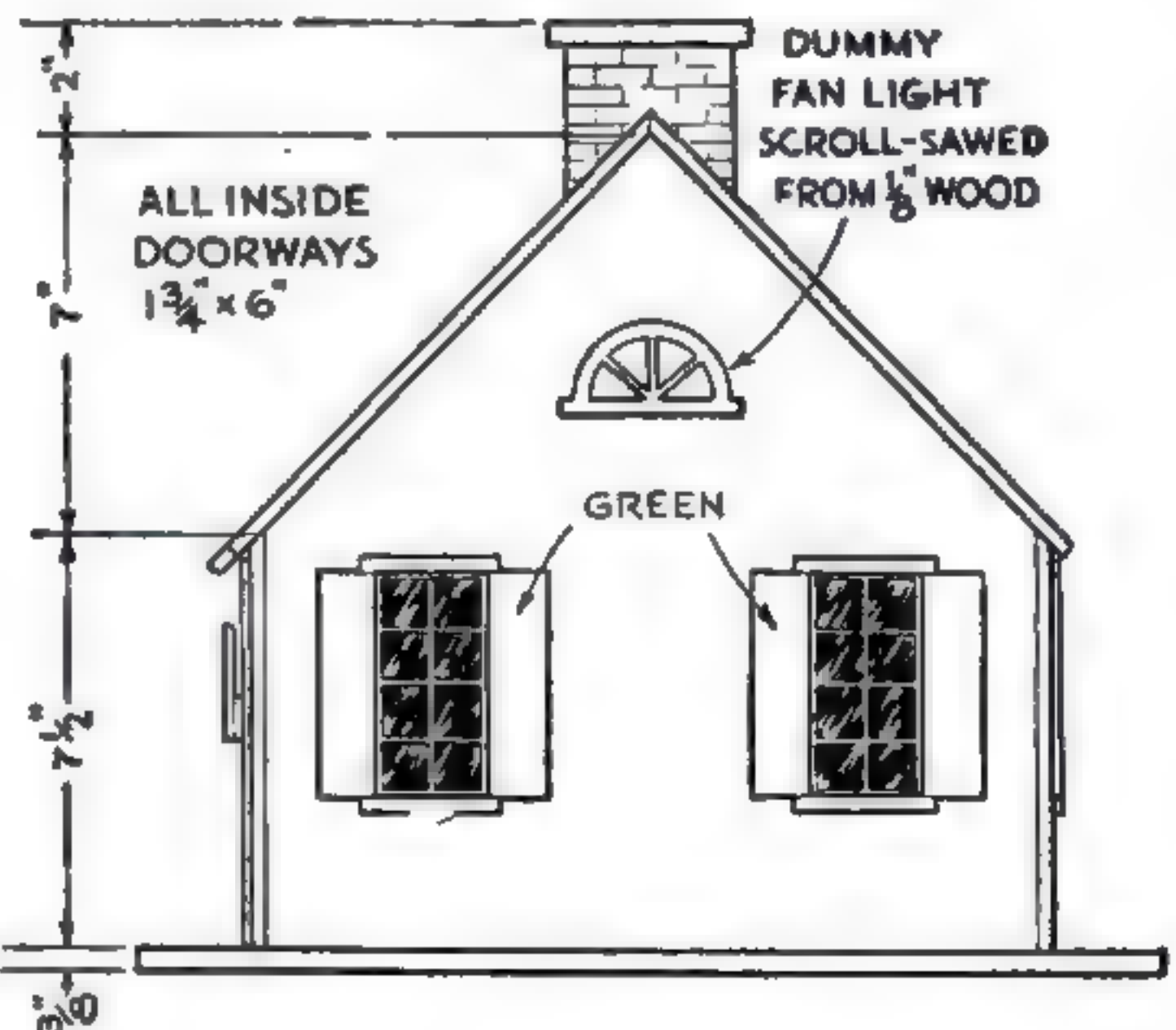
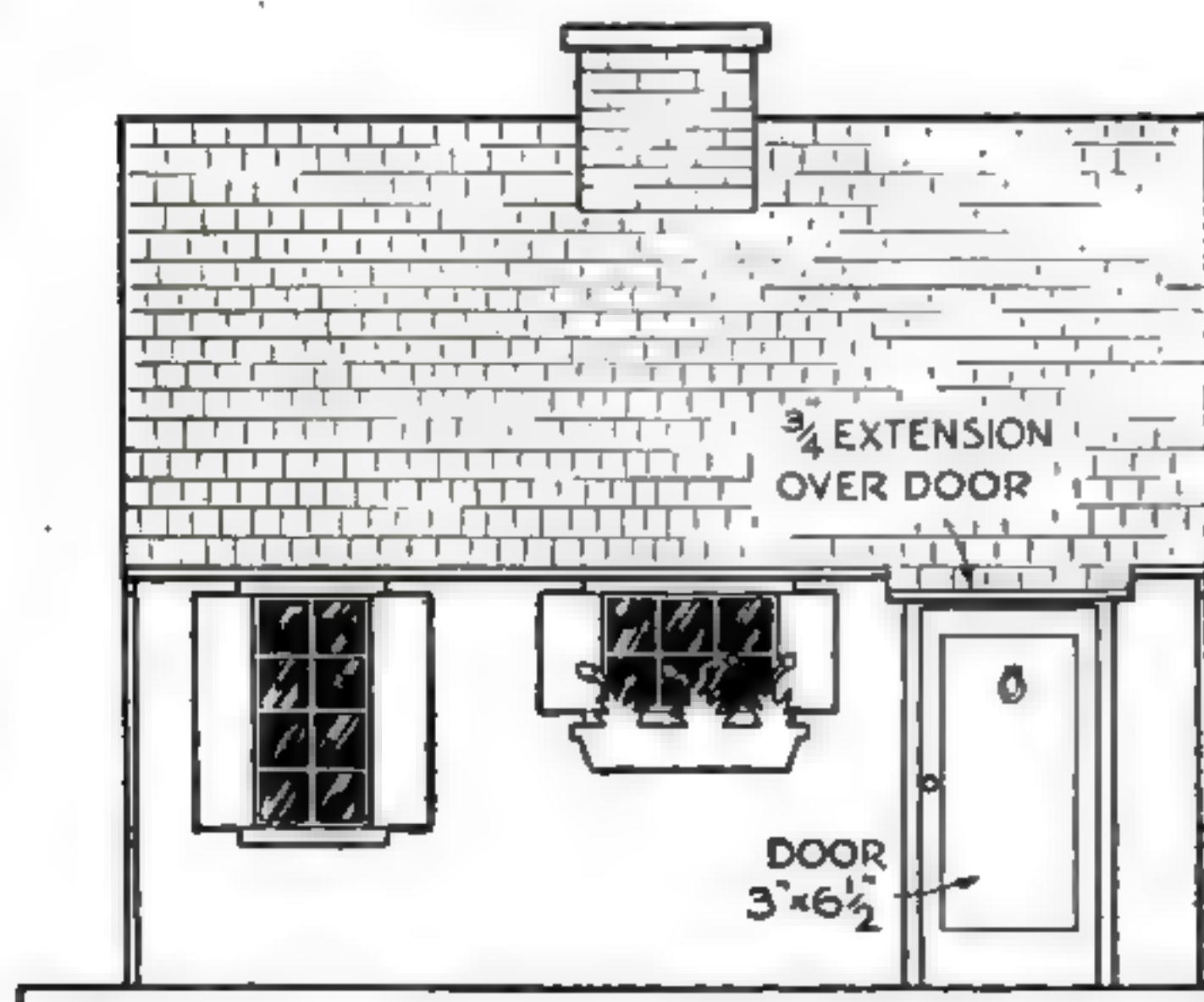


A celluloid pane is cut to fit in each window opening, held on the inside by a thin strip of wood and on the outside by the shutters, sill, and head trim or lintel, after the white sash strips have been stuck on.

On the original model the two outside doors are hinged to swing in, but if many doll houses are to be built they may be dummies, framed on the wall.

Note the simplicity of the roof shingles—a series of light lengthwise cuts made on the circular saw, and shingle divisions indented with a chisel. The bricks in the chimney are made in the same way.

The window box and plants are scroll-sawed and painted green except for the buds, which are red. Use white for the walls and green for the roof and shutters of the doll house.



DOLL HOUSE



It saves time to paper or decorate the interior walls before assembly

LIST OF MATERIALS

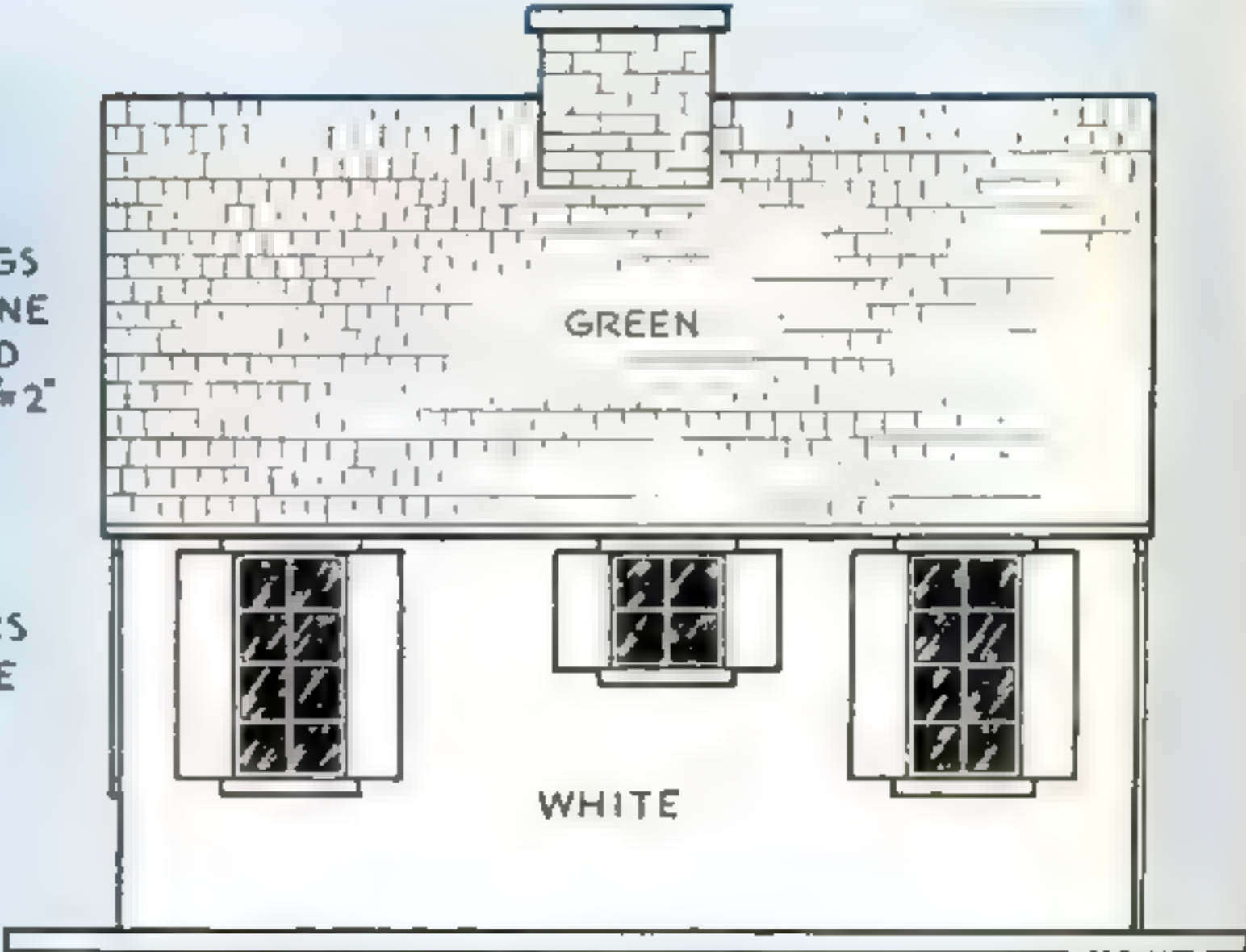
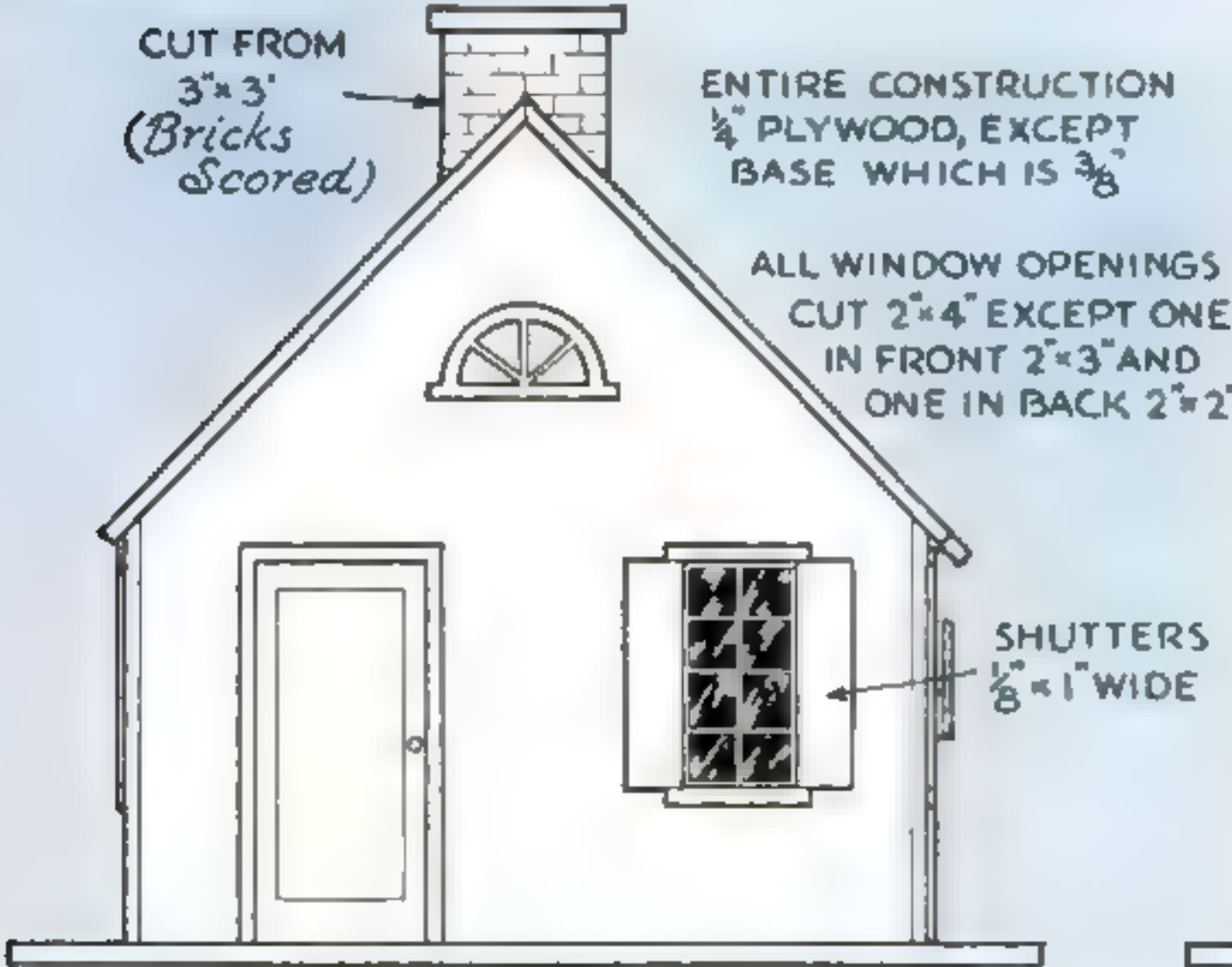
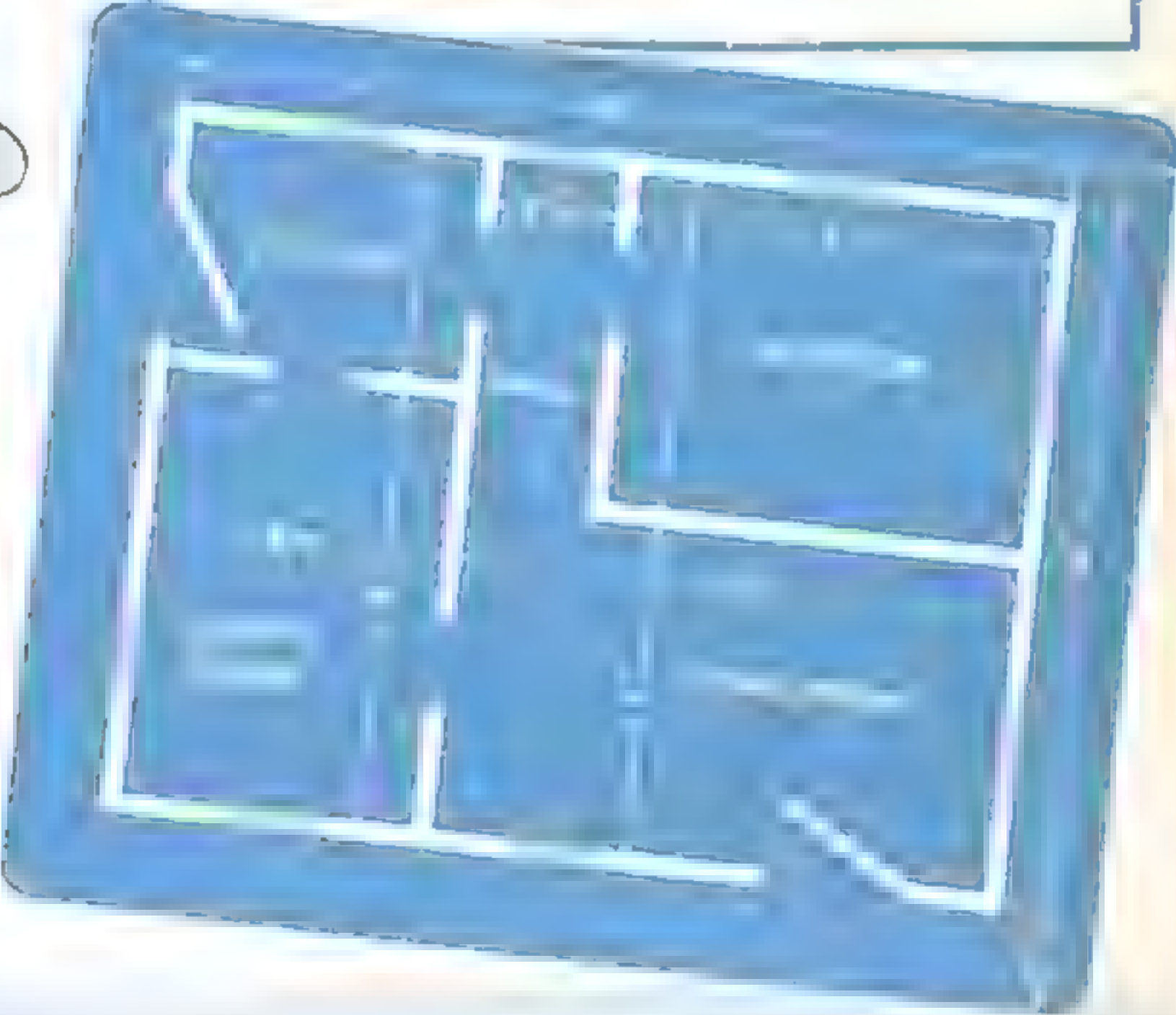
PLYWOOD

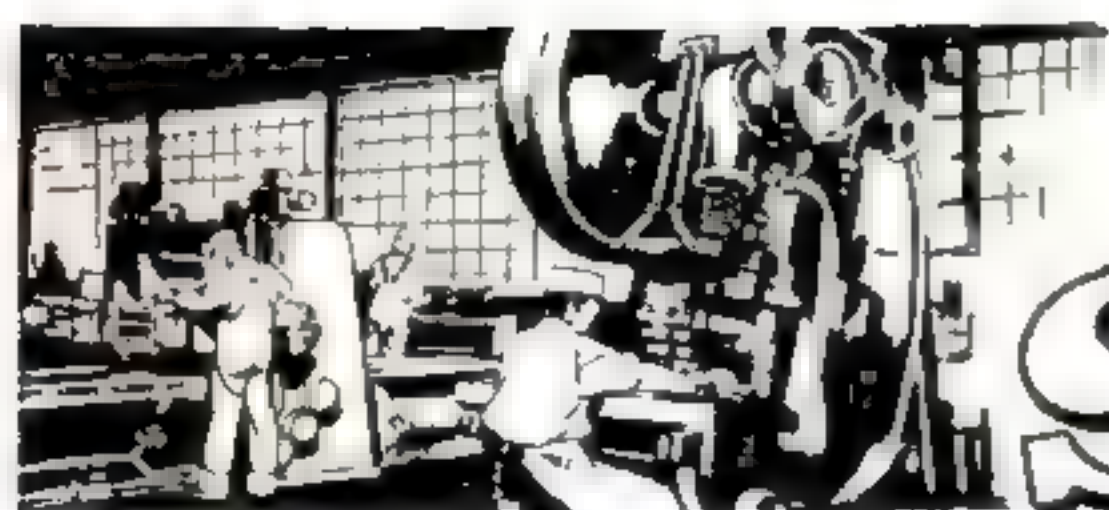
No. Pc.	Description	T.	W.	L.
1	Base	3/8	18	22
2	Ends (allows for trimming)	1/4	14	15
2	Walls	1/4	7 1/2	18
2	Roof	1/4	11	18 1/2
1	Ceiling	1/4	13 1/2	17 1/2
1	Partition	1/4	7 1/2	13 1/2
1	"	1/4	7 1/2	9
1	"	1/4	7 1/2	7
1	"	1/4	7 1/2	6 1/2

WHITE PINE

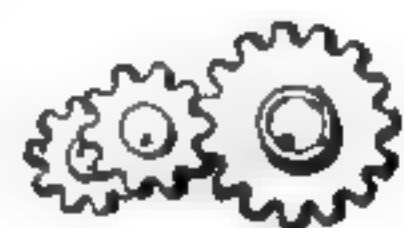
14	Sills and head trim	1/8	1/4	2 1/4
2	" " " "	1/8	1 1/4	3 1/4
12	Shutters	1/8	1	4
2	"	1/8	1	3
2	"	1/8	1	2
4	Door frames	1/8	1/4	6 1/2
2	" " " "	1/8	1/4	3 1/2
6	Celluloid for windows		2	4
1	" " " "		2	3
1	" " " "		2	2
1	Chimney	3	3	3

Material for chimney cap, fanlight frames, flower box, and door knob; brads, glue, paint, passe partout.





new SHOP IDEAS



ANY AMATEUR MACHINIST
CAN MAKE THESE USEFUL



A small tool-post lamp. It can be plugged into the beveled duplex outlet to slant either way

AMATEUR machinists usually enjoy making accessories for their metal-turning lathes, and several of these are shown in the accompanying illustrations.

Of all the methods of illuminating lathe work, the tool-post lamp is considered the best. The one shown was made from a

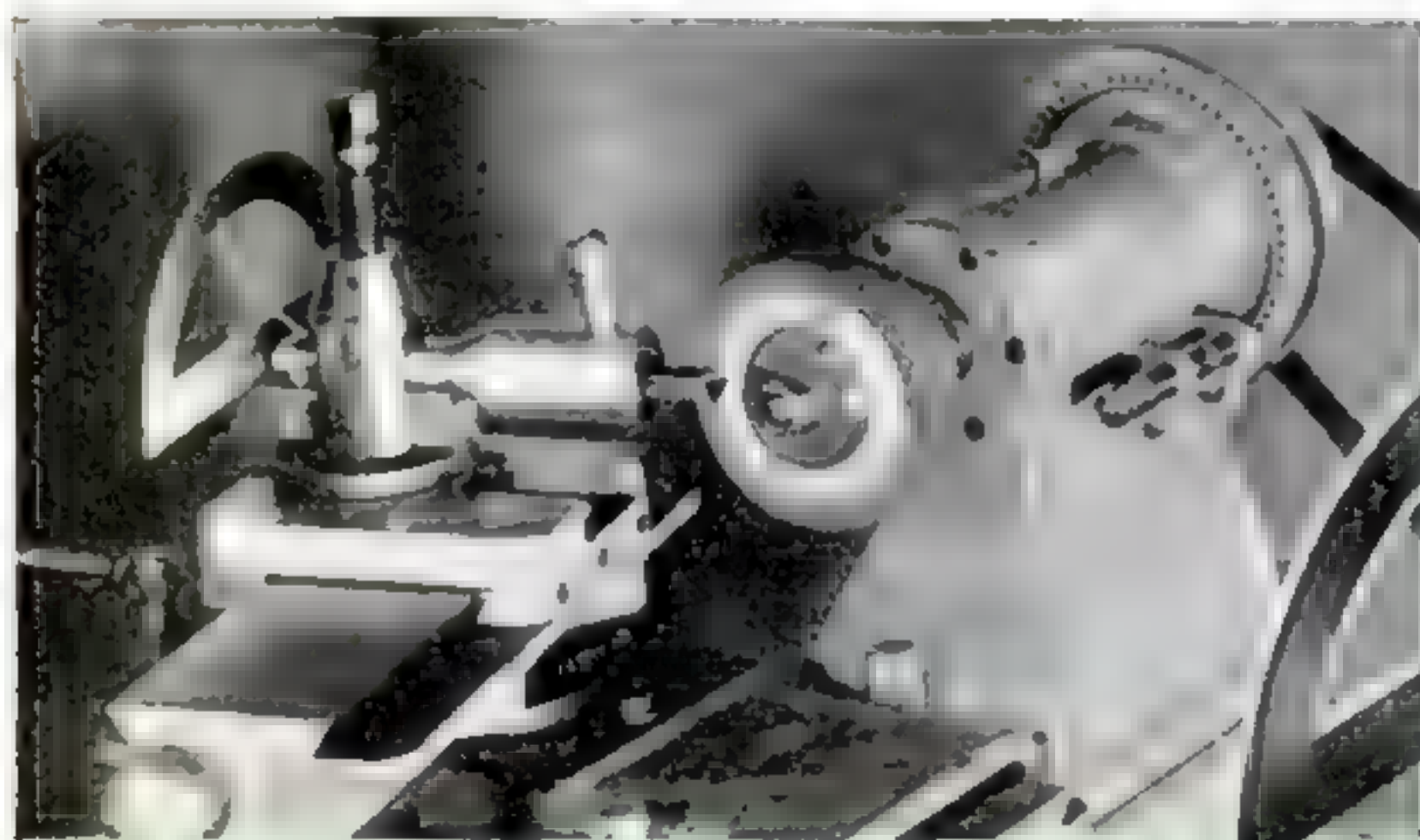
By HOWARD R. HEYDORF



small sewing-machine or night light designed for a 7-watt bulb. The base of the light is a two-way wall outlet of the type hav-

ing a beveled top and intended to be screwed to the baseboard. This is fastened to a piece of brass that is placed over the tool post and under the washer. Mounted in this way, the light throws the illumination directly on the cutting tool.

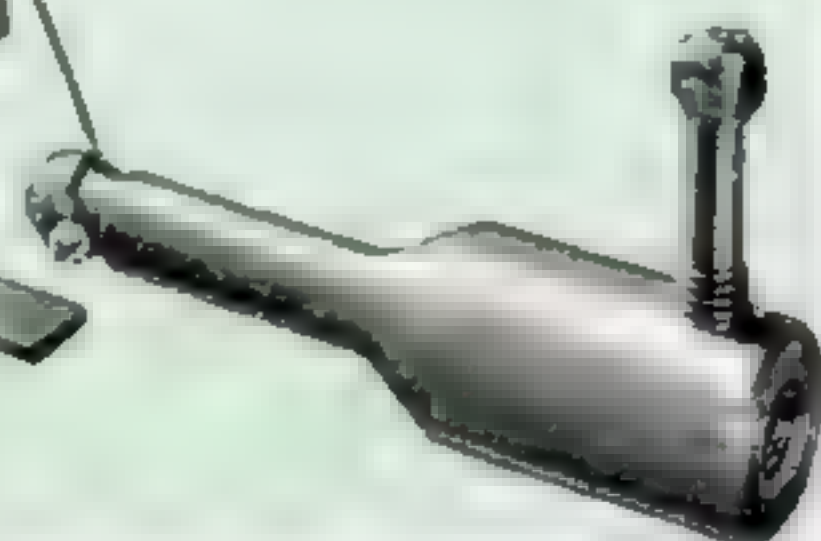
The second device is a tool-bit grinding attachment. The tool holder is made from a good grade of steel, the shank being turned to fit the tool-post slot. A hole is bored in



This tool-bit grinding attachment has a protractor and pointer for the speedy and accurate adjustment of any required vertical angle



How the protractor is mounted and the tool holder made





The slide-rest cover, cut from auto-roofing material or other heavy fabric, has a hole that slips over the lathe tool post

the end to take the tool bit and is provided with a set screw. The one used in this case was shaped from a carriage bolt. The back end of the holder is drilled to take a small wire pointer, which is held in place with a set screw. A scale for the vertical angles is made from a small protractor and fastened to a strip of brass that fits under the tool-holder shank. It is best to have the protractor markings on the outside and bend the pointer as indicated. This grinding jig may have to be blocked up to bring the tool bit up to the center line of the wheel. Ad-



A piece of brass tube, which fits over the tailstock sleeve, slides out to cover the dead center and stop any oil spatters

just the holder to give the correct vertical angle, and use the slide-rest swivel to give the other angle. Do the grinding with a wheel of fine grit by passing the tool bit lightly along the side of the grinding wheel. Cool the bit with ice cubes or a wet cloth.

Oil that is placed on the dead-center end of a turning is likely to be thrown off and soil the clothing of the operator. On work of small diameter this can be checked by fitting a piece of brass tubing over the tailstock sleeve as shown below. The center is oiled and then the tube is moved out to cover the center and stop any oil spatters.

Lathe operators quickly learn the importance of keeping the slide rest free of metal chips and dirt. A cover made from auto-roofing material or other heavy fabric will accomplish this. Cut the holder in the center so that it can be slipped over the tool post and held with the regular washer.

The tool-post light described on the preceding page is very effective for small work, but is equally good for large work where the tool must be watched.

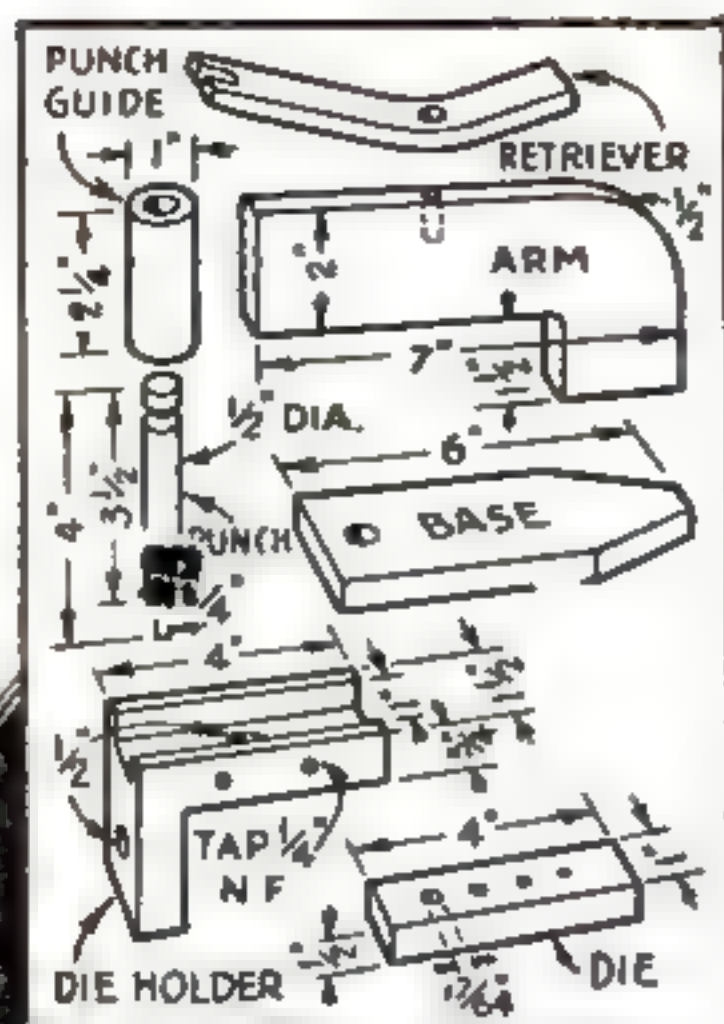
How to Pour Liquids Neatly from Rectangular Cans

FOR pouring liquids such as varnishes and oils from square or rectangular cans that have the opening in one corner of the top, the can should be held so that the opening is up rather than down. The opening then remains at a sufficient elevation with re-

spect to the fluid in the can so that nothing escapes until the can is nearly horizontal, and the pouring can be done neatly and without dribbling. This method also allows air to enter more freely and avoids intermittent surges of liquid.—W. A. CRAIG.

A Hammer-Operated Punch for Light Work

The frame of the punch is assembled by welding, and it is used with a hammer as shown below



serve as a guide for the punch. It is best to drill the guide smaller than required, then weld it to the arm and, after it has cooled, drill the hole to the finished size.

To do the welding, place the pieces in position, heat both to a dark red, spot the guide to the arm at each end, then start at one end and weld the seam completely. Turn the work over and weld the other seam, beginning at the hottest end. A suitable base is then welded to the arm by following the same procedure. Use a No. 4 tip and $\frac{1}{8}$ " filler rod.

The die holder is a piece of mild steel bar bent to a right angle as shown and slotted to hold the die. The die is made from mild steel, or preferably a piece of key stock. It is drilled for whatever holes are most commonly required, but it is advisable to make them $\frac{1}{64}$ " larger than the holes to be punched. Two set screws hold the die in place. The die holder is mounted solidly on a bench block or a heavy piece of steel or cast iron. The punches are turned from cold-rolled stock and hardened by heating with the torch and plunging into oil.

To withdraw the punch from the work, it is necessary to provide a retriever on top of the arm as illustrated. The end of the retriever is struck to withdraw the punch.

IF OXYACETYLENE welding equipment is available, it is a comparatively simple matter to construct a small punch for making holes in spring steel up to $\frac{3}{32}$ " thick and mild steel $\frac{1}{8}$ " thick.

The arm is cut from a piece of $\frac{1}{2}$ " plate to the end of which is welded a piece of 1" shafting with a hole drilled through it to



Simple Wire Stand Supports Magnifier for Drafting

FOR very finely detailed drafting or bench work on minute parts, a large magnifying glass may be supported by means of a wire frame made as shown below. It holds the glass at the proper distance to keep it in focus, thus leaving both hands free for working. The stand is constructed from a piece of stiff wire. The size of the base loop depends on the magnifying glass used, but it should be about $\frac{1}{2}$ " larger in diameter than the glass. The height of the supporting stem is determined by looking through the glass and moving it up and down till the most satisfactory magnification is obtained.

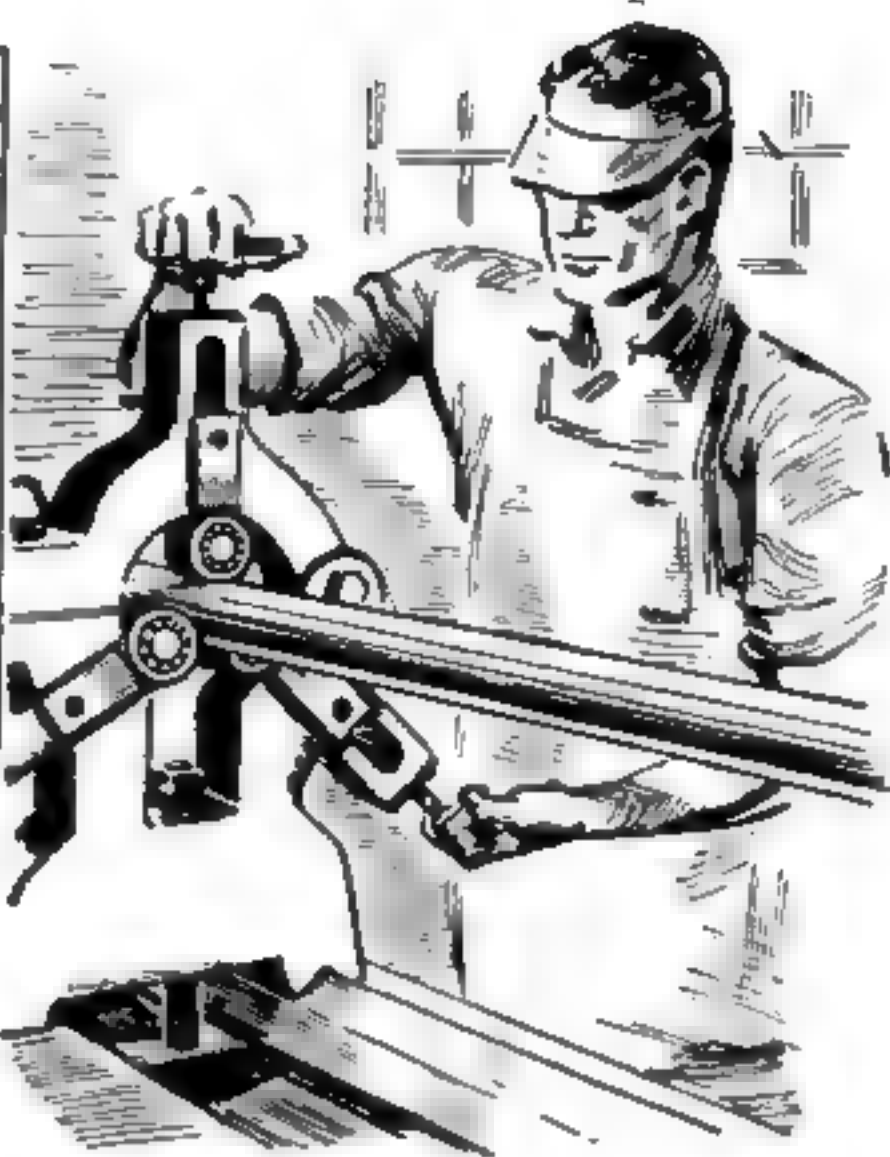
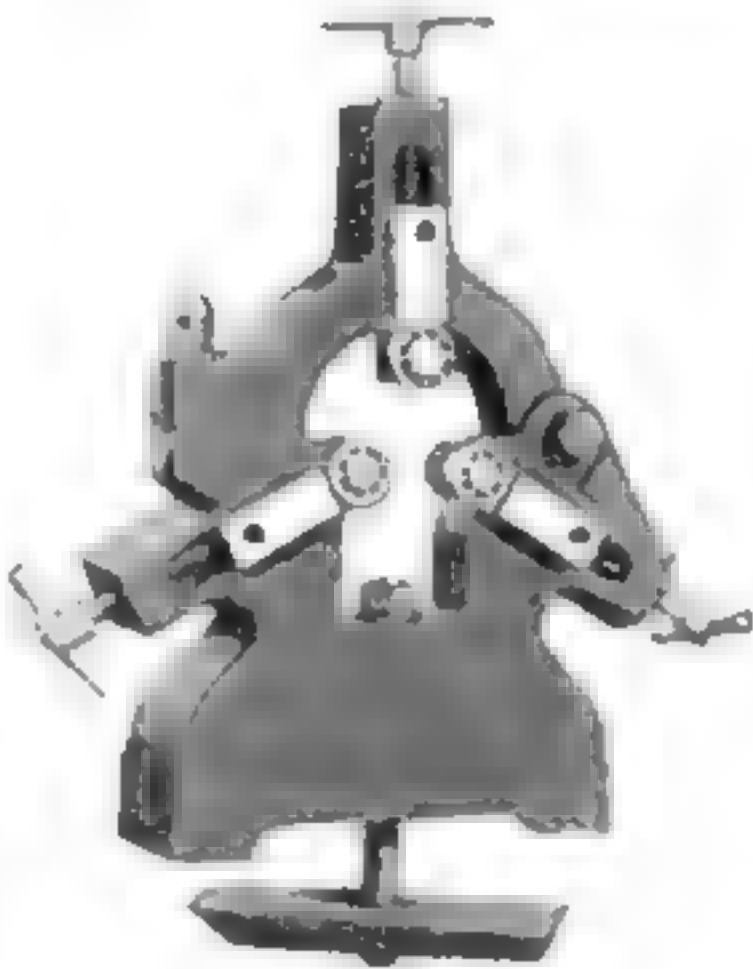
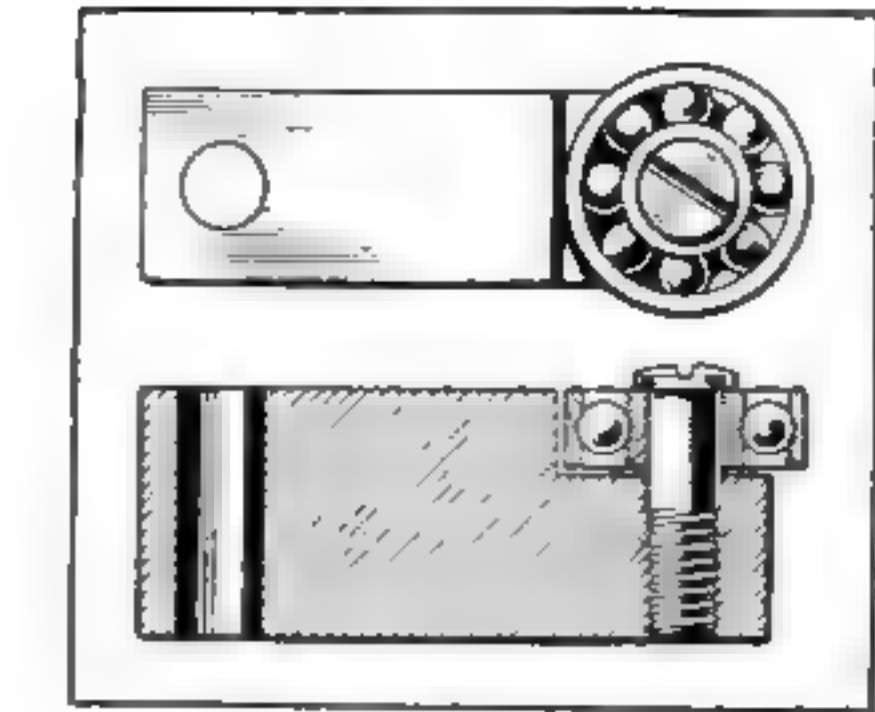
Rubber Band Marks a Triangular Scale

MUCH time can be saved in using a triangular drafting scale if a rubber band is used as illustrated above to show at a glance the edge being used. A marker, such as a small piece of drafting tape, is attached to the band adjacent to this edge.—D. D. GURNEE.



Fastening Drawings with Paper Tape

DRAFTING tape, now so generally used to fasten paper on drawing boards, is theoretically ideal, but sometimes dirt gets into the gum on the tape and soils the drawing. This can be avoided by applying the tape as illustrated below. A small piece is stuck to the underside of the paper at each corner, gummed side up, with half the width extending beyond the edge. Place the paper on the board and stick down each protruding tab of drafting tape by applying another piece of tape over it. — WILLIAM G. PARTKIN.



Ball Bearings Improve Jaws of Steady Rest

BY ALTERING a lathe steady rest as illustrated above and adding three ball bearings, work may be turned in it at high speed without being scored by the jaws. Dimensions will have to be adapted, of course, to suit the steady rest, but in this case 1½" ball races were fastened to the jaws in such a way that the rim of the races would bear against the work to be supported.

If the ball races available happen to be too large to slide through the slot provided in the steady rest, new jaws may be made, which is not a difficult task, or the ball races may be fastened in such a way that they do not have to slide in the slot.—GEORGE S. WALKER.



A bit of drafting tape is stuck under each corner so it projects like a tab. Another piece fastens it to the board

CARRYING CAPACITY OF WIRES

[ELECTRICAL]

Rubber-covered copper wires have a safe carrying capacity as indicated in the following table. In wiring fixtures, Nos. 18 and 16 are usually used; the other sizes are for circuit runs, mains, and submains. However, when Nos. 18 and 16 are used in portable cords, they may carry 5 and 7 amperes respectively.

No. 18.....	3 amperes	No. 8.....	35 amperes
16.....	6 "	6.....	50 "
14.....	15 "	4.....	70 "
12.....	20 "	2.....	90 "
10.....	25 "	1.....	100 "

If an appliance is rated in watts and you want to know how many amperes it uses, divide the watts by the voltage (usually 110 or 115) and the result gives the amperes.

In electrical work it is important to know the meanings of the following common terms: VOLTS. Pressure, or electromotive force. AMPERES. Quantity, or the current flowing in a circuit. OHMS. An ohm is the electrical unit of resistance. WATTS. The product obtained by multiplying the volts by the amperes. KILOWATTS. A kilowatt is 1,000 watts. KILOWATT-HOUR. One kilowatt used for one hour.

Boat-Planking Hints

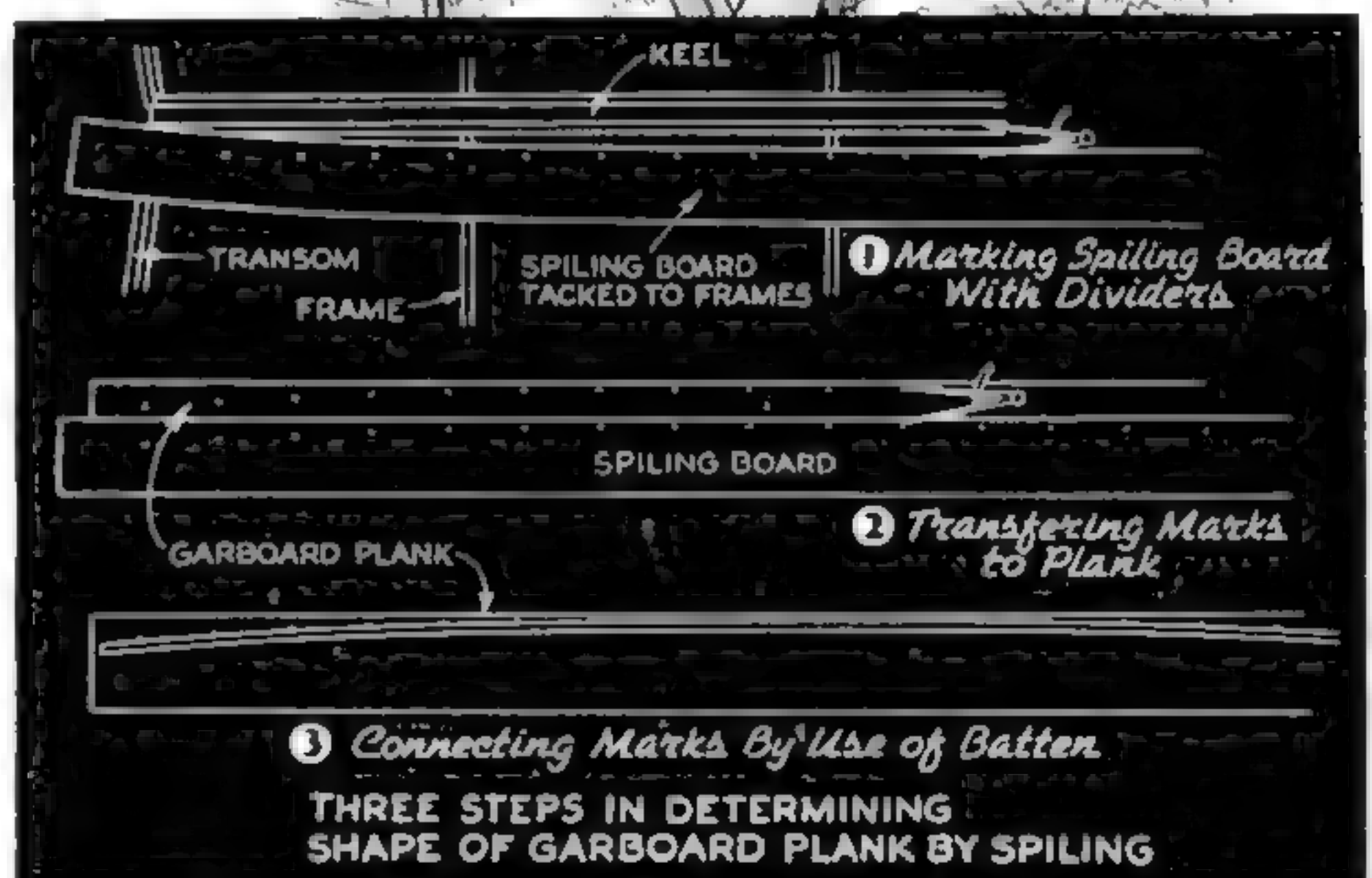
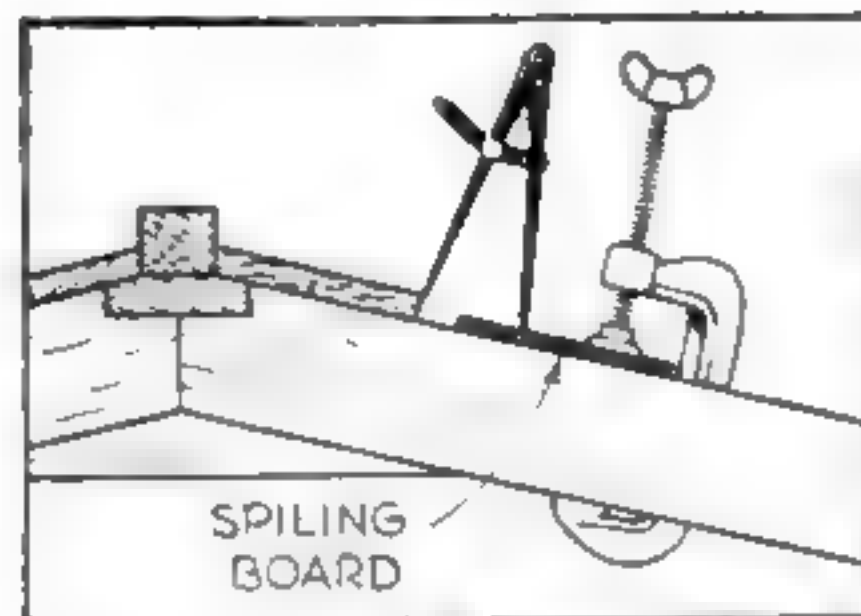
By
**BRUCE and
WILLARD
CRANDALL**

ON THE simplest flat-bottom boats, straight planks can be used for planking, but in the case of all more complicated designs at least some of the planks will be found to take various peculiar shapes.

One of the simplest ways to find the correct shape is to clamp the plank to be fitted in place over the framework of the boat and as close to the plank it is to fit against as possible, without forcing; then transfer the shape from the edge of the other plank by means of a pencil compass. Remove the plank, saw and plane it to shape, and clamp it again in position for its final fitting.

In many cases, however, the shape can be determined by clamping the plank in position with the edge lapping over the previous plank, and then marking from the inside with a pencil; or the shape may be transferred by chalking the edge of the previous plank. With batten-seam boats in which the battens are all put in ahead of time, the shape of each plank can be found by marking from underneath along the edge of the batten with the plank in place and later adding one half the width of the batten. After a plank is cut to shape, it can be used as a pattern for the similar plank on the other side of the boat.

In case there is too great a bend to allow the plank to be forced easily into position for fitting, it is best to use the method that boat builders call "spiling." A thin piece of



When planks have to be bent considerably, the best method is to use a thin spiling board for transferring the exact shape

material less than half the thickness of the planking, known as a "spiling board," is clamped or tacked in position over the frames as close to the edge of the preceding plank as possible, but it is permitted to bend in its natural way over the framing with absolutely no edge spring. The shape

is then transferred to the spiling plank by pricking it with a pair of dividers every 4" or 6". The dividers must be held at right angles to the keel at all times. Then remove the spiling plank and clamp it against the edge of the plank that is to be cut to shape. With the dividers still set the same, transfer the marks onto the plank itself. Take off the spiling plank and connect up the marks by the use of a bending batten. In order that the same spiling plank may be used over and over again, the correct prick marks can be marked with chalk each time and the chalk later rubbed off.

Another method of using a spiling plank consists of drawing a series of lines across



it and taking measurements along these lines while the spiling plank is clamped in place. In another and very simple method, a series of short sticks are tacked to the spiling board while it is

in position over the frames in such a way that the end of each stick touches the edge of the plank already in place. The spiling board is then removed and clamped to the plank that is to be cut, and the shape is transferred by making a mark at the end of each stick and connecting the marks.

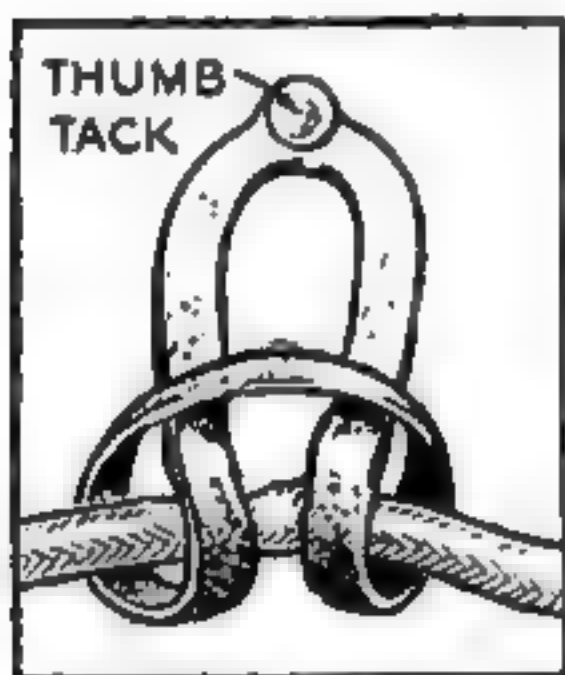
One advantage of using a spiling board is that it allows the cutting of two corresponding planks, one for each side of the boat, at the same time. Stock 1" thick is used and resawed later.

Suction Cups Painted to Match Walls

RUBBER suction cups, which are usually black, can be made less conspicuous on walls finished in white or pastel shades by painting them with the elastic white rubber-base coating sold by automobile supply stores for use on the side walls of tires. This special paint can be tinted any light color desired with dry pigments.—K. L. R.



Jar Rings Support Extension Cords



EXTENSION lamp cords may be safely supported when necessary by looping rubber Mason jar rings around the cord as shown. The ring may be hooked over a convenient nail or fastened with a thumb tack through the lip. The advantage of this method over using staples or tacks is that the soft rubber will not fray the cord and will "give" somewhat if a sudden strain is applied.—W. J. WHITBECK.

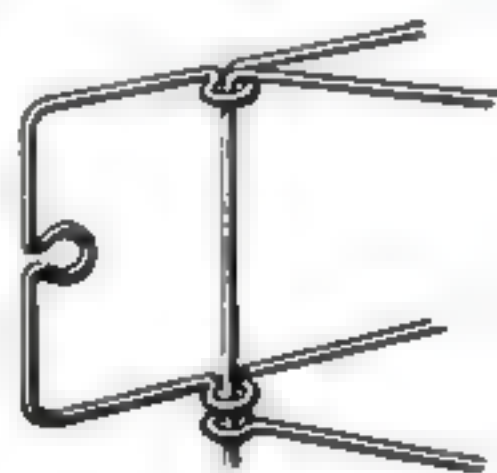
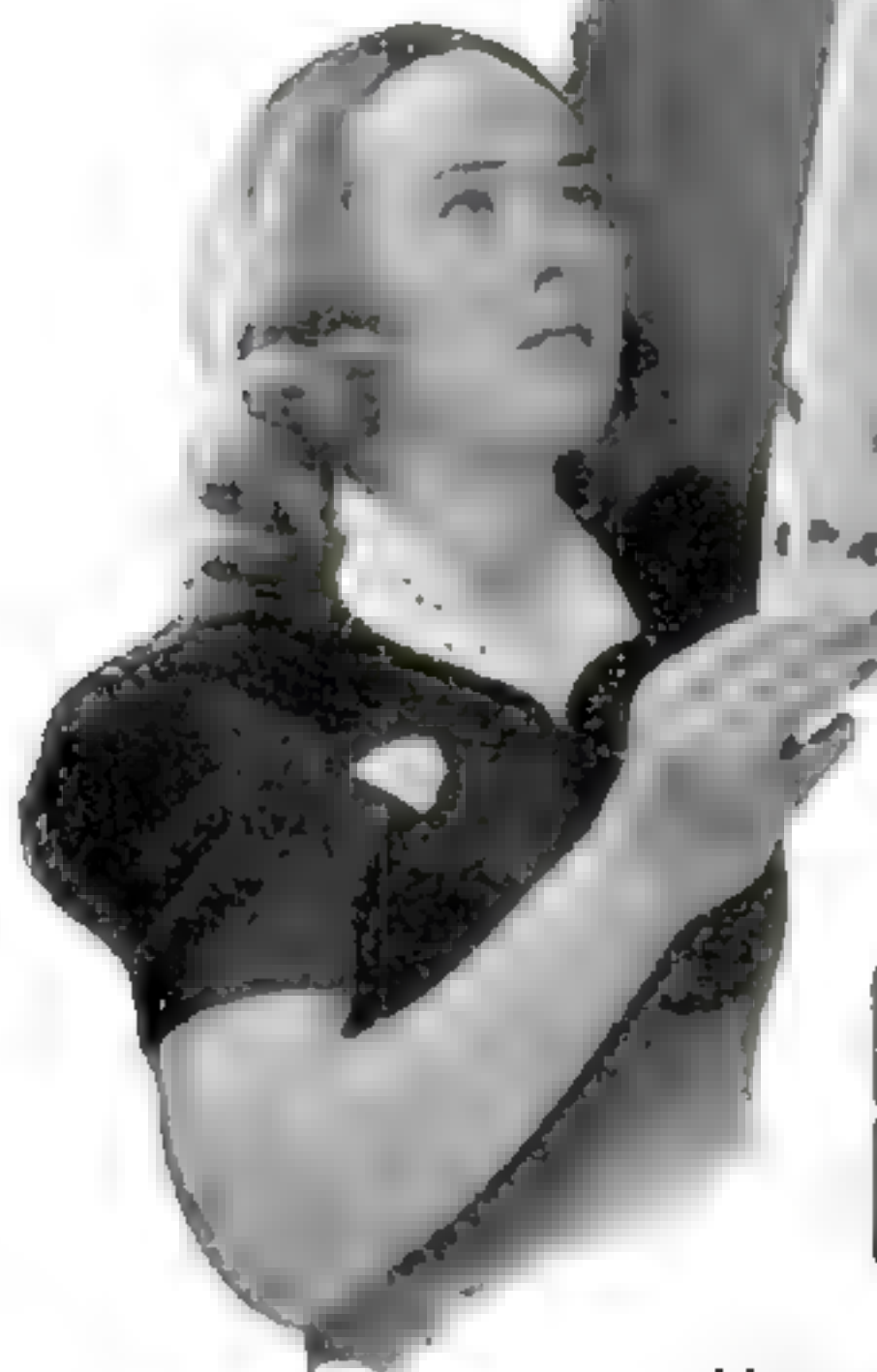
Ornamental Flower Stands Bent from Junked Brake Rods

ORNAMENTAL flowerpot stands are easily made without either a forge or a welding outfit from ordinary round steel rods such as are used for brake rods on autos.

Full-size drawings should first be made on heavy paper, and this gives the craftsman ample opportunity to exercise his originality. The iron rods are then bent to conform with the plans. A blowtorch will supply the heat necessary to facilitate bending. The joints are heavily soldered, and the whole stand carefully polished with emery cloth. After a coat of metal primer has been applied, the piece is given two coats of enamel.—W. J. V.



Towel rack with five swinging wire arms. These must be well enameled to prevent danger of rusting



How arms of the towel rack are supported by small parallel loops

Wire Novelties

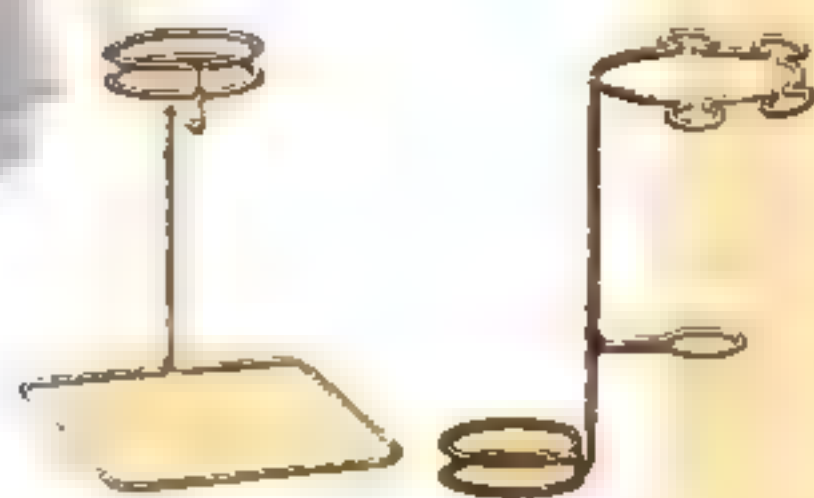
A number of new uses to which to put discarded coat hangers

OLD wire coat hangers provide material for many useful little devices. Several suggestions are given in the accompanying illustrations.

The ornamental book ends are each bent from a single piece of wire and may be any desired size. The closet hat holders have a loop at the top and two parallel loops at the lower end to clamp over the edge of a shelf. A similar clamp is used in making the soap-dish support and the rack for holding a glass and toothbrushes. Both of these fasten on a shelf in the bathroom.

The letter rack is formed from a single length. A letter opener to match may also be made of wire, and one edge can be sharpened sufficiently to cut paper by rubbing it down on an oilstone. The joint comes at the end of the handle, where it is soldered.

A more elaborate piece is the towel rack.



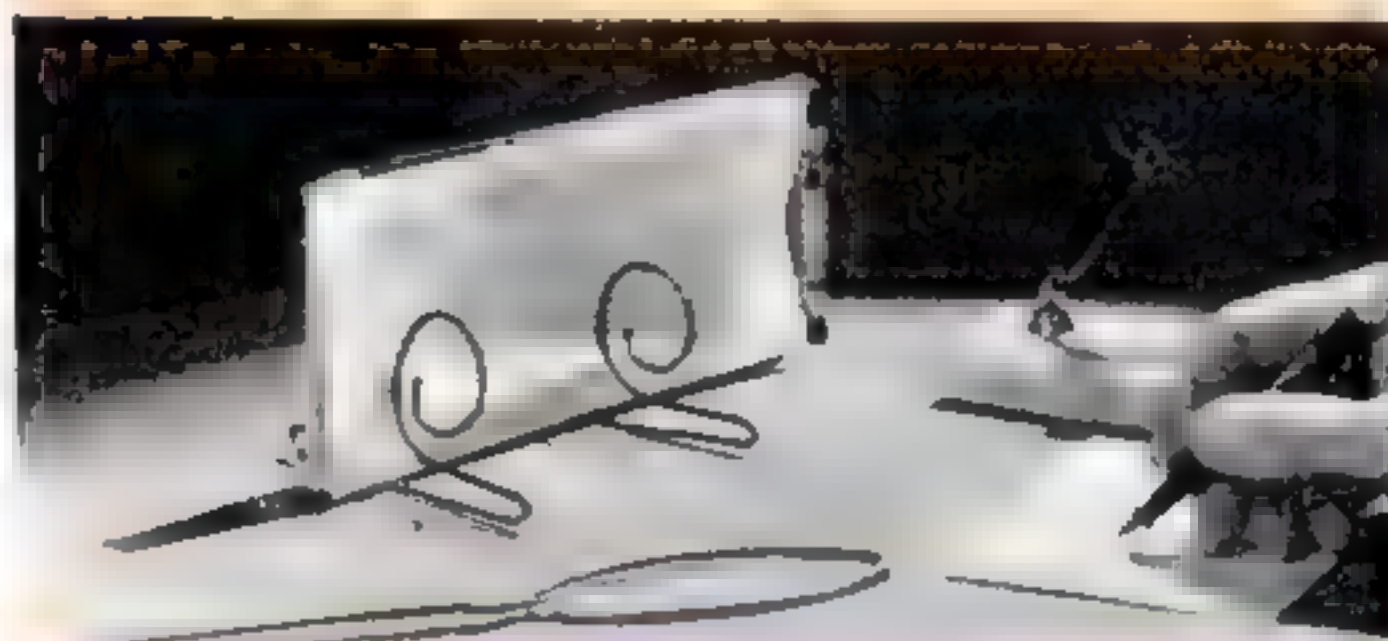
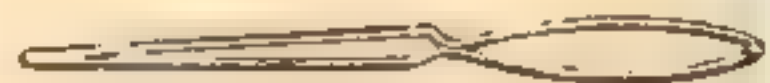
Holders for soap dish, glass, and toothbrushes



Hat hanger designed to clamp on a closet shelf

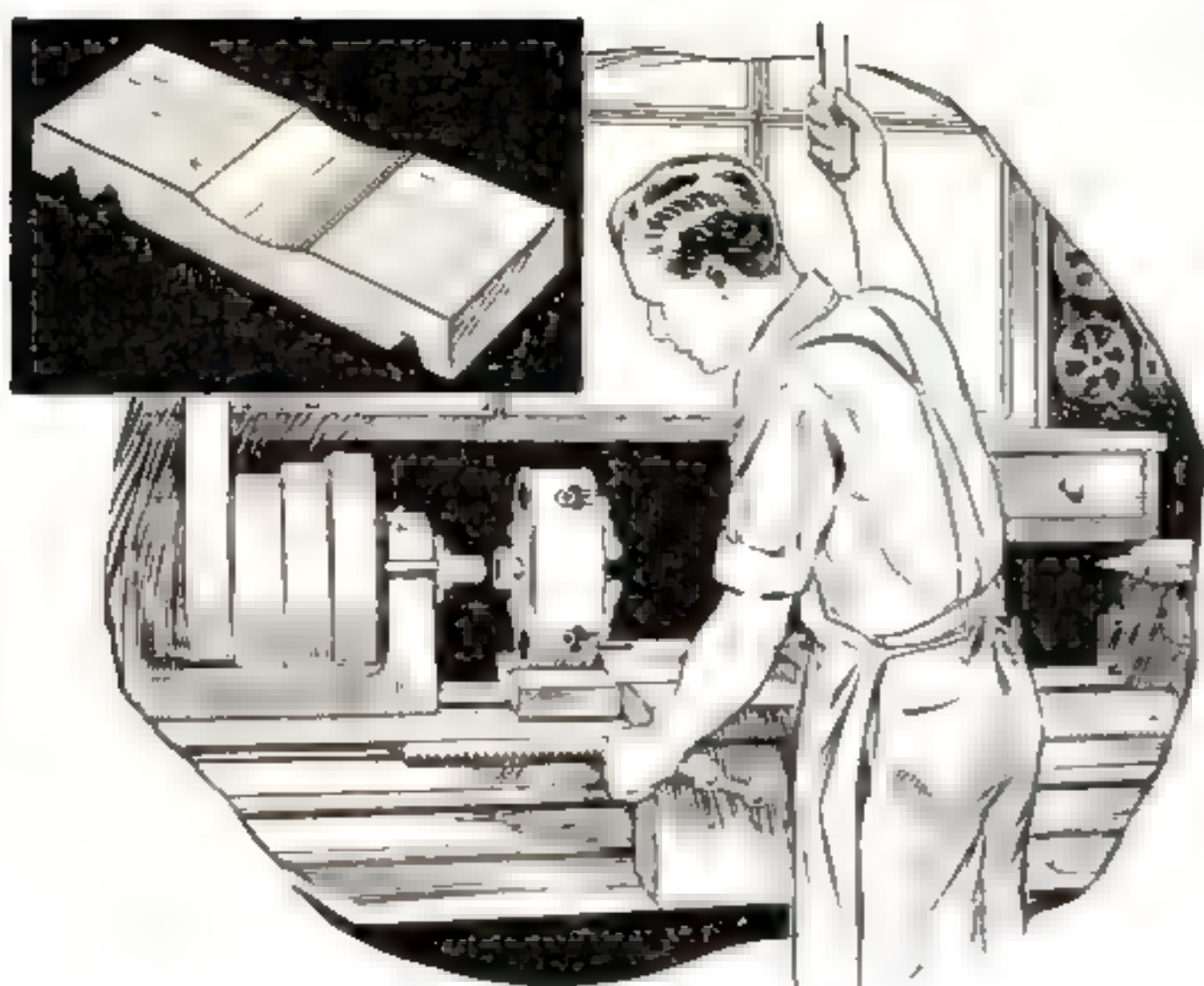


Book ends, each bent in one piece



A letter rack with wire paper cutter to match

This consists of five arms held by parallel loops bent in the wire support. The latter is in the shape of a rectangle with loops at each end to enable it to be screwed to the wall.—FRANK CAPORAE.



Board Aids in Mounting a Heavy Lathe Chuck

MUCH effort can be saved in putting on and removing a heavy lathe chuck if a hardwood board about 2" thick is notched to fit the ways and recessed on top so as to hold the chuck in line with the spindle threads. After the chuck has been set on the board, the lathe can be started and the carriage run up against the edge of the board to push it and the chuck up to the spindle as shown above.—JOHN C. ZIMBECK.

Cork Disks for Small Gaskets

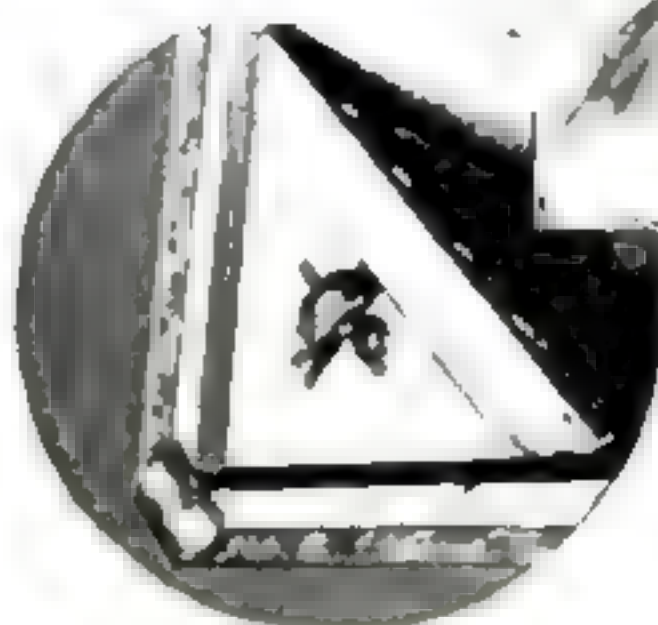
CORK disks pried from bottle caps can be used to make gaskets for small fittings such as those on water hose. Cut a suitable hole and trim to fit the coupling.—R. O. F.

Small Snowplow on Wheels Can Be Pushed Easily

SNOW can quickly be removed from sidewalks, provided the fall is not too heavy, by using a small snowplow constructed as illustrated. Three triangular blocks, slotted to receive roller-skate wheels, are screwed to the frame so it will run without dragging. Two heavy sheet-iron blades are screwed to the lower edge of the plow. A small metal strip is fastened to the underside of the point and bent up in front to permit the plow to rise and roll over uneven surfaces.—B. N.



The snowplow runs on three small wheels



At left, each roller-skate wheel is set in a slotted triangular block. The handle is from a lawn mower

FINISHING RADIATORS AND PIPES

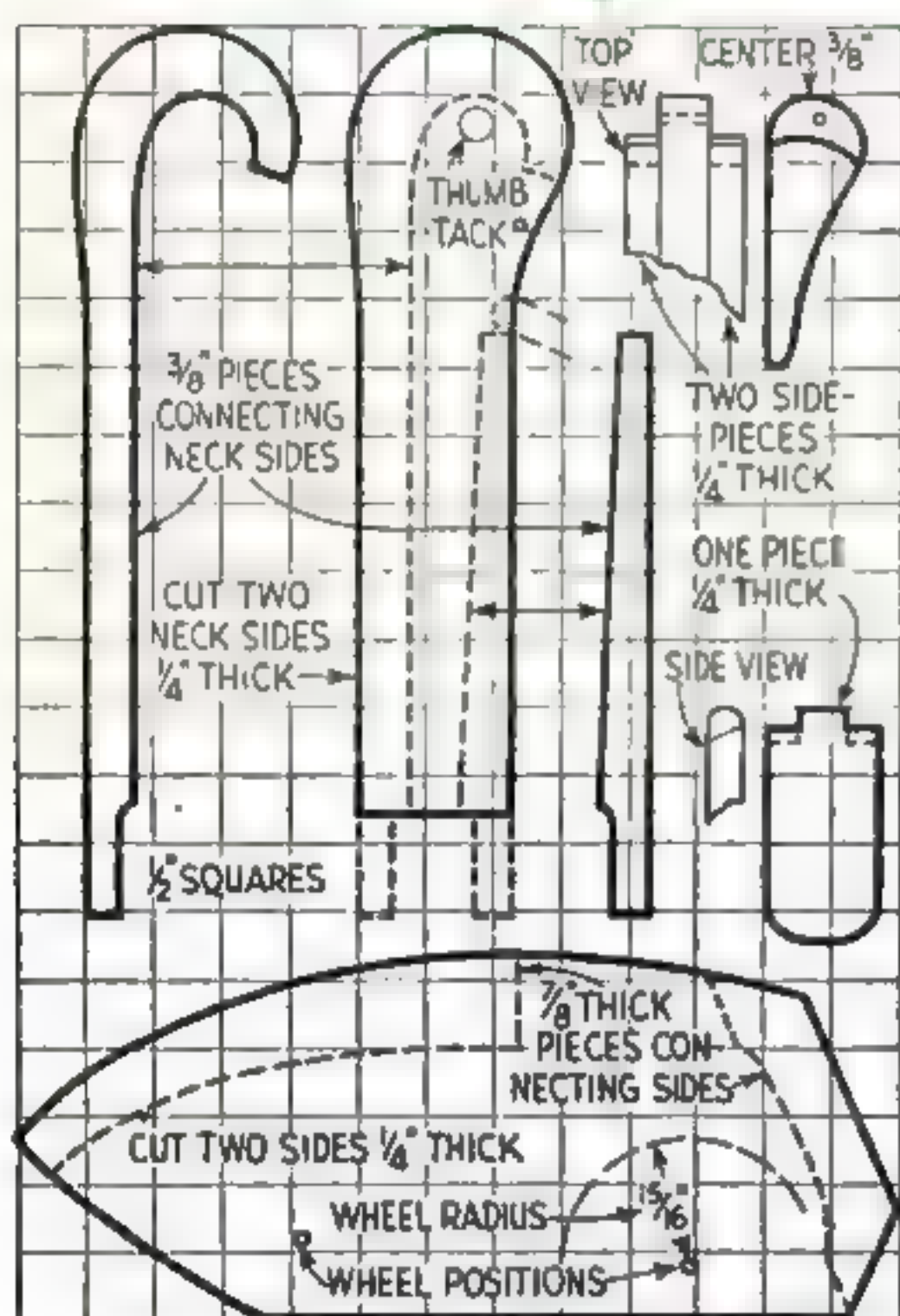
[PAINTING]

1. Clean surface with sandpaper and steel scratch brush. Wipe with clean rags and denatured alcohol to remove all traces of oil and grease. Do not use gasoline.
2. Radiators, if new and unpainted, should receive a first coat of standard metal primer, which should be allowed to dry hard.
3. The finishing coats should be an eggshell or flat finish identical with the wall or woodwork of the room. This type of finish gives increased heat value. Avoid using bronzes, if possible, because they cause a definite loss in heating value, particularly on radiators.
4. Allow all possible time for drying before the heat is turned on, and then bring the heat up slowly over a twelve-hour period.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

FOR THE Home Workshop Santa Claus

EIGHT PAGES OF NOVEL
WITHOUT DIFFICULTY AND



Gabby the Duck Moves Her Head and Bill When Pulled

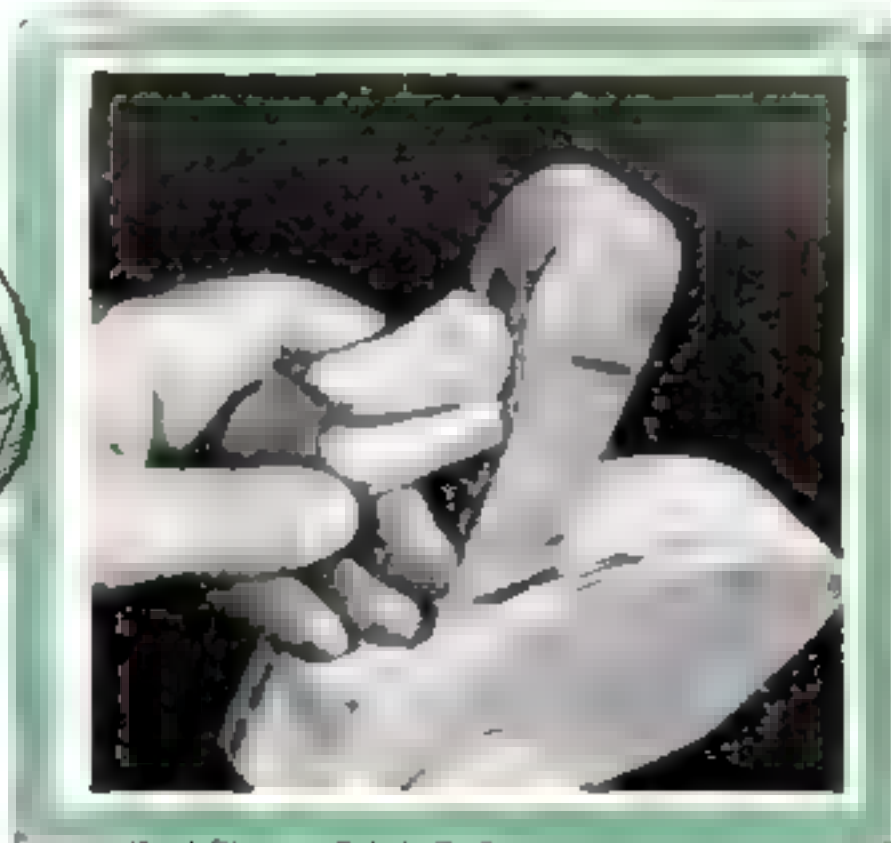
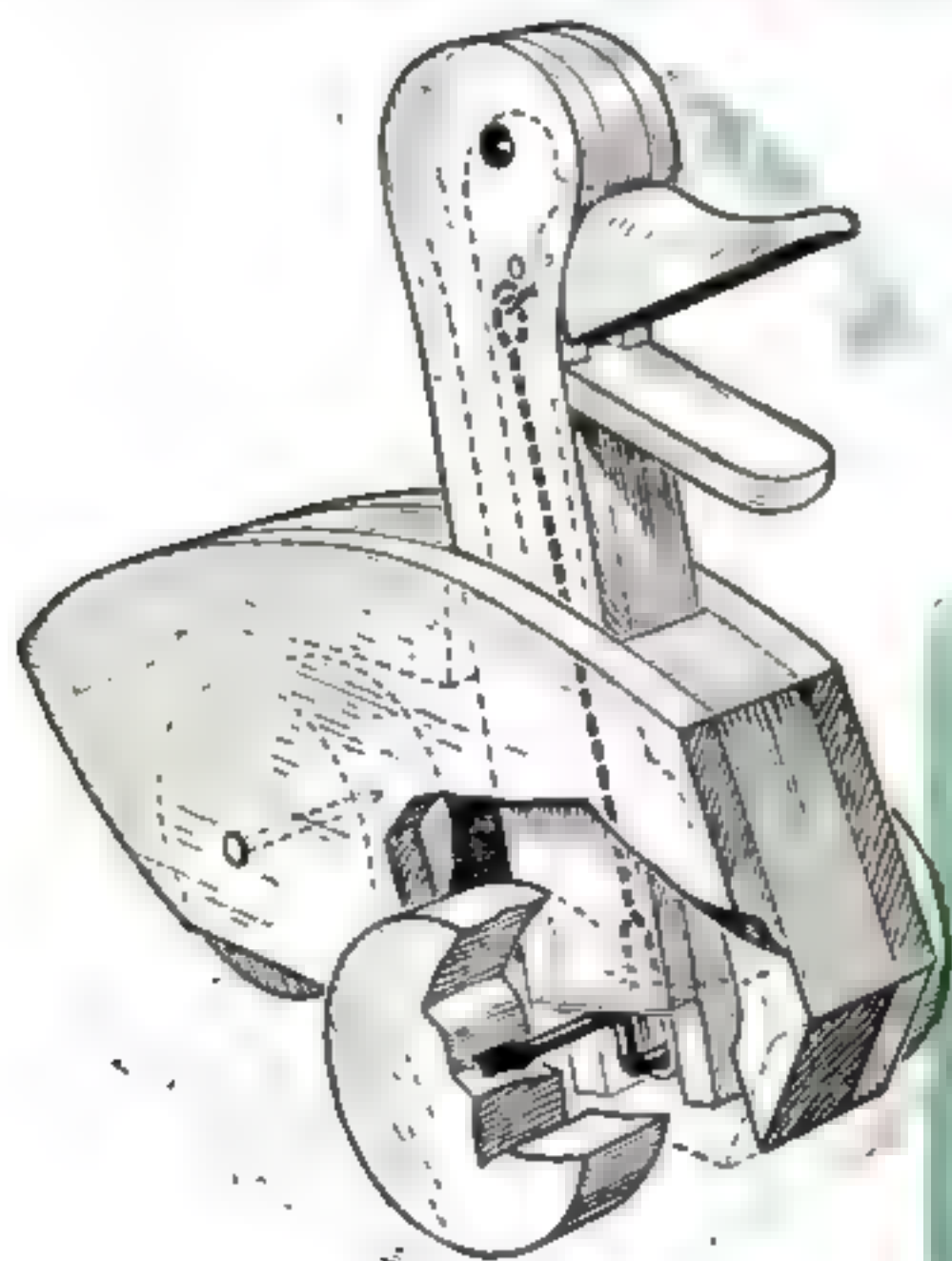
GABBY is an expressive little duck who captures the interest of children because of her lifelike movements. When pulled along the floor with a string, Gabby moves her head back and forth, and at the same time opens and closes her bill.

Because the mechanical action is very simple, this toy is easily constructed singly or in quantity. Required are some $\frac{1}{4}$ " plywood, pine, stiff fence wire, a screw eye, and thumb tacks. The latter serve as eyes.

The head and neck consist of four parts. The two connecting pieces are sandwiched between two outside pieces, all cut from plywood. Shape the bill from pine, gluing the lower half in place and attaching the

upper with a small pin. A small screw eye is placed in the upper bill to receive a connecting rod made from fence wire.

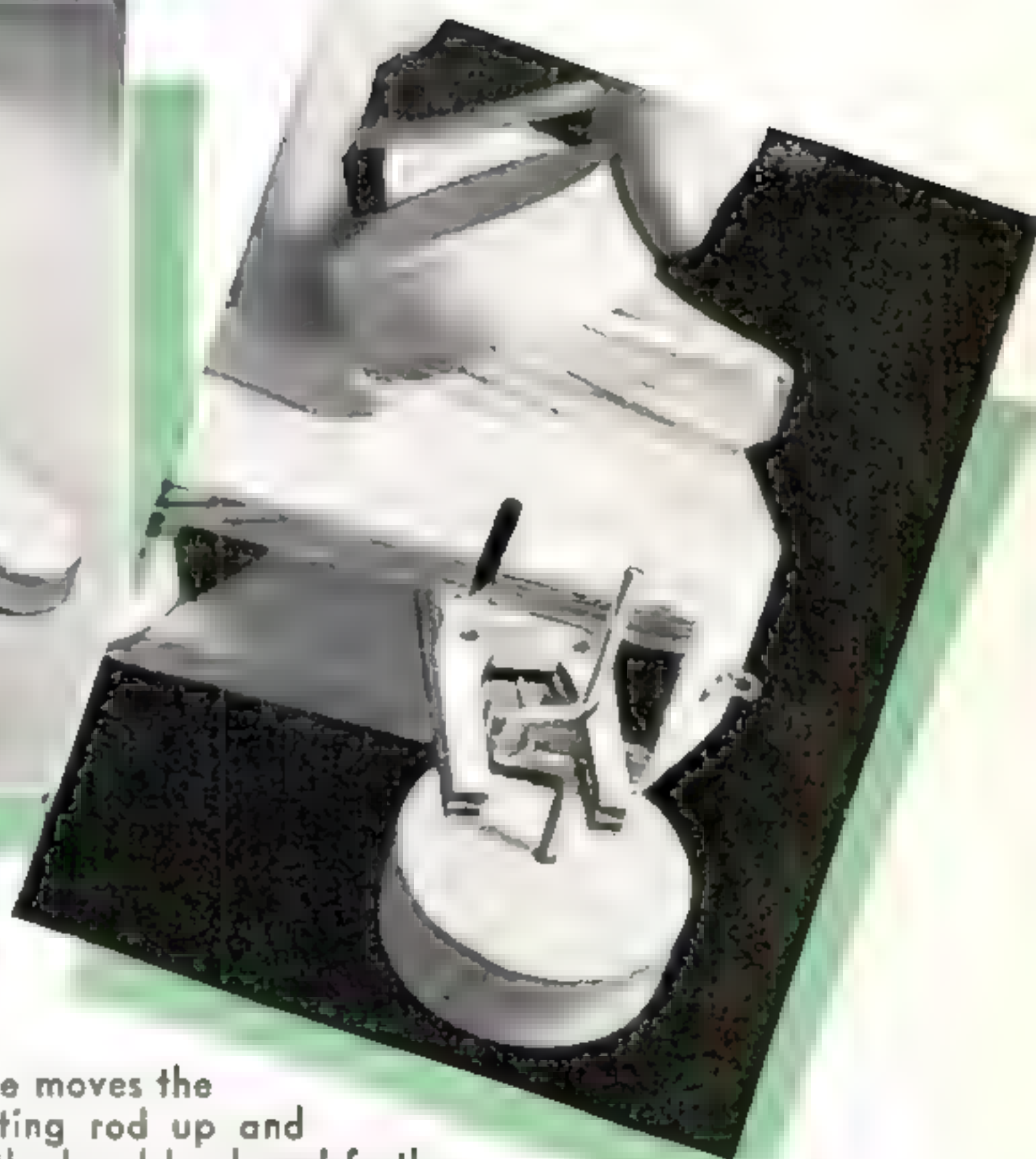
The body consists of two pieces of $\frac{1}{4}$ " plywood separated by two pieces cut from pine $\frac{7}{8}$ " thick, all the parts being assembled with glue and brads. Two $1\frac{7}{8}$ " drive wheels in front and one $1\frac{3}{4}$ " wheel at the rear are cut from $\frac{3}{4}$ " pine.



CHRISTMAS-GIFT PROJECTS YOU CAN CONSTRUCT AT COMPARATIVELY LITTLE EXPENSE FOR MATERIAL



The parts ready to be assembled. Note the long connecting rod that operates the bill



Form the axle from fence wire, flattening the ends so that they can be pressed into the wheels for a tight fit after the axle has been passed through the loop in the lower end of the connecting rod. Fit the axle into slots cut into the body, then close the slots with

The axle moves the connecting rod up and down, the head back and forth

brads or small wooden wedges. Enamel the body in two colors or two shades of one color and make the bill yellow.—E. A. BOWER.

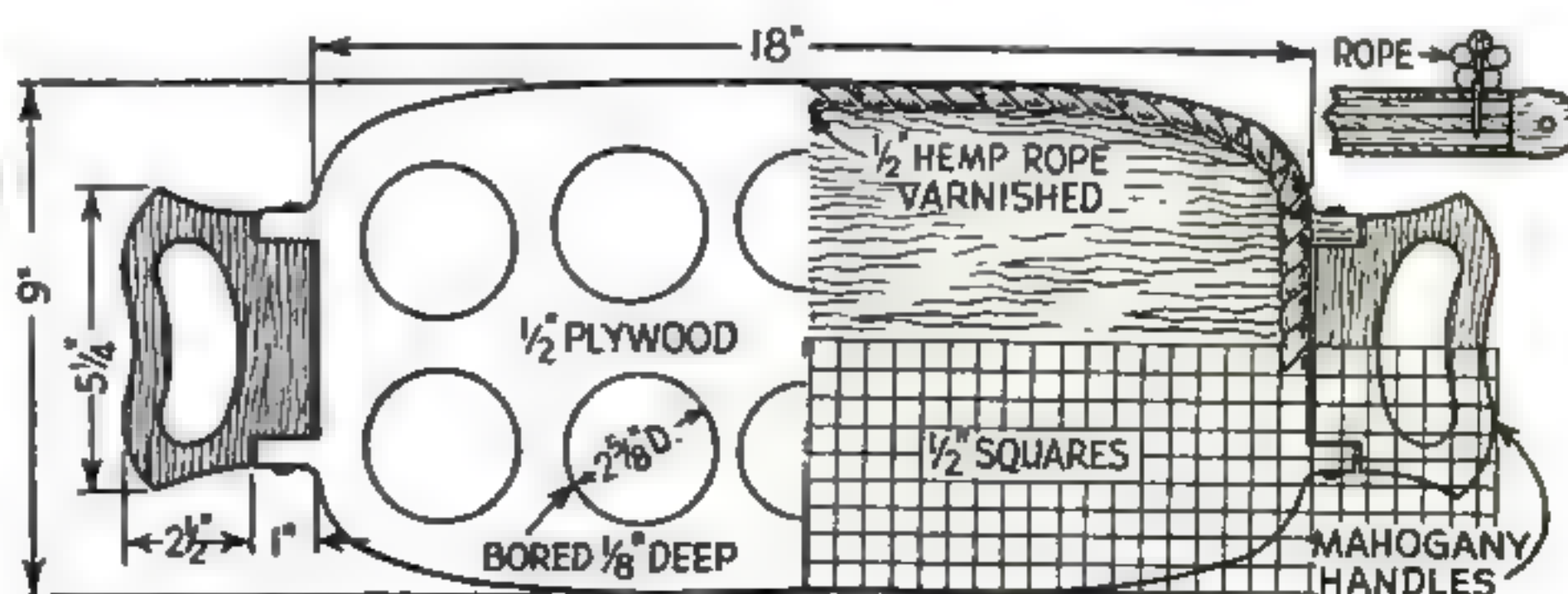


This natural-finished plywood tray is edged with rope and has recesses on one side for glasses. The hinged handles are mahogany

Flip-Over Tray Gives Double Service

ON ONE side of the unique refreshment tray illustrated at the left are circular recesses for ten beverage glasses so they can be carried without danger of spilling. The other side of the tray is flat for holding plates of sandwiches, cakes, and tea things. These are prevented from sliding off by the edging of rope. The handles swing both ways so the tray may be carried either side up.

Plywood $\frac{1}{2}$ " thick is used, and a piece should be selected that has an attractive grain on both sides unless the tray is to be enameled when finished. It is scroll-sawed to shape, and the reverse side is bored about $\frac{1}{8}$ " deep for





the tumblers. A suitable boring tool in the drill press will do this work. The $\frac{1}{2}$ " hemp rope border is secured with brass escutcheon pins. If you are not familiar with making a spliced joint, bring the ends

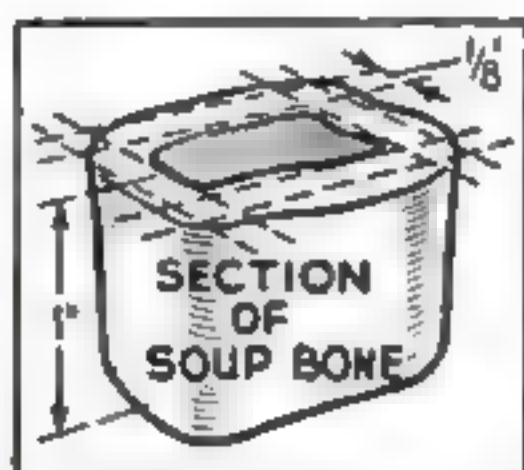
together (after they have been bound with brown twine) and varnish them liberally, as well as the remainder of the rope.



Reversed, the tray has a flat surface for dishes

Mahogany in natural finish makes attractive handles, contrasting with the lighter plywood.—LOWELL R. BROWNE.

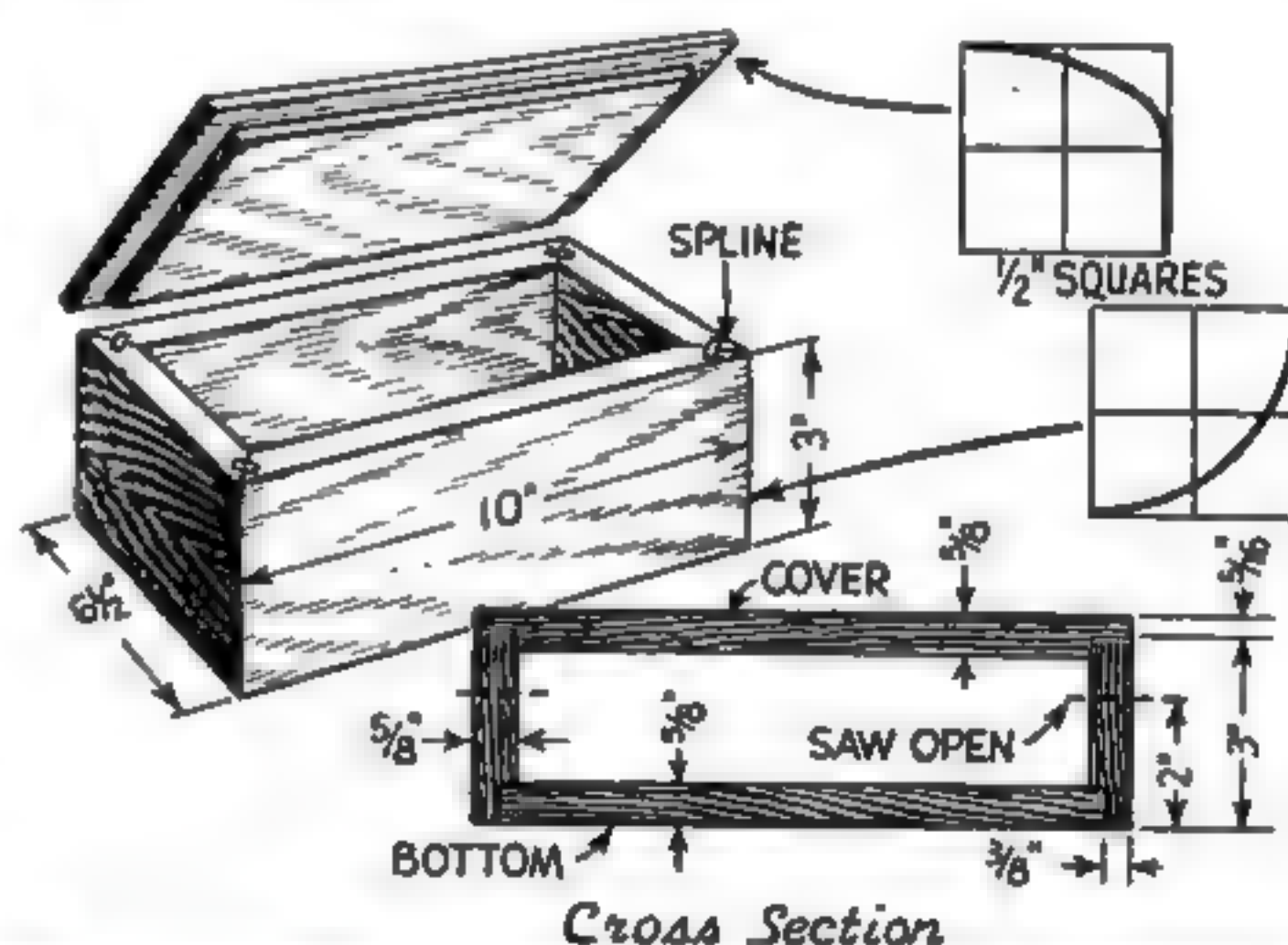
Soup-Bone Inlays Ornament a Playing-Card Box



square is cut from the best section of the bone with a hack saw. The thickness should be approximately $\frac{1}{8}$ ". A paper pattern is cut out for each of the four card symbols and pasted on the flat pieces of bone. The inlay designs are then sawed out roughly with a fine coping saw and finished accurately with small files.

In removing the wood for the inlays, first lay the pieces of bone in their proper positions on the top of the box and trace around them with a fine-pointed lead pencil. The bone designs are glued in place and sanded.

Although any favored finish may be used, several coats of boiled linseed oil applied to the box and vigorously rubbed down will produce a satin effect.—G. A. S.



IT IS surprising what beautiful inlay work can be done with ordinary bone. Take, for example, this attractive card or novelty box. The box itself is made from straight-grained $\frac{3}{4}$ " walnut. The splined miter and rabbet joints are easily prepared on a power saw, although a good job can be done with hand tools if necessary. Glue the parts together before separating the lid. When it has been sawed off, attach the lid to the box with two $\frac{1}{2}$ " by $1\frac{1}{2}$ " brass hinges recessed into the wood. The top of the lid is worked down with files and sandpaper around the four edges to give it a pleasing pillow effect. The four side edges are then smoothly rounded to conform with the top.

The four pieces for the inlays are sawed from a soup bone that has been cooked and thoroughly dried. A section at least $\frac{3}{4}$ "





Mariner's Dual-Purpose Lamp and Ash Tray

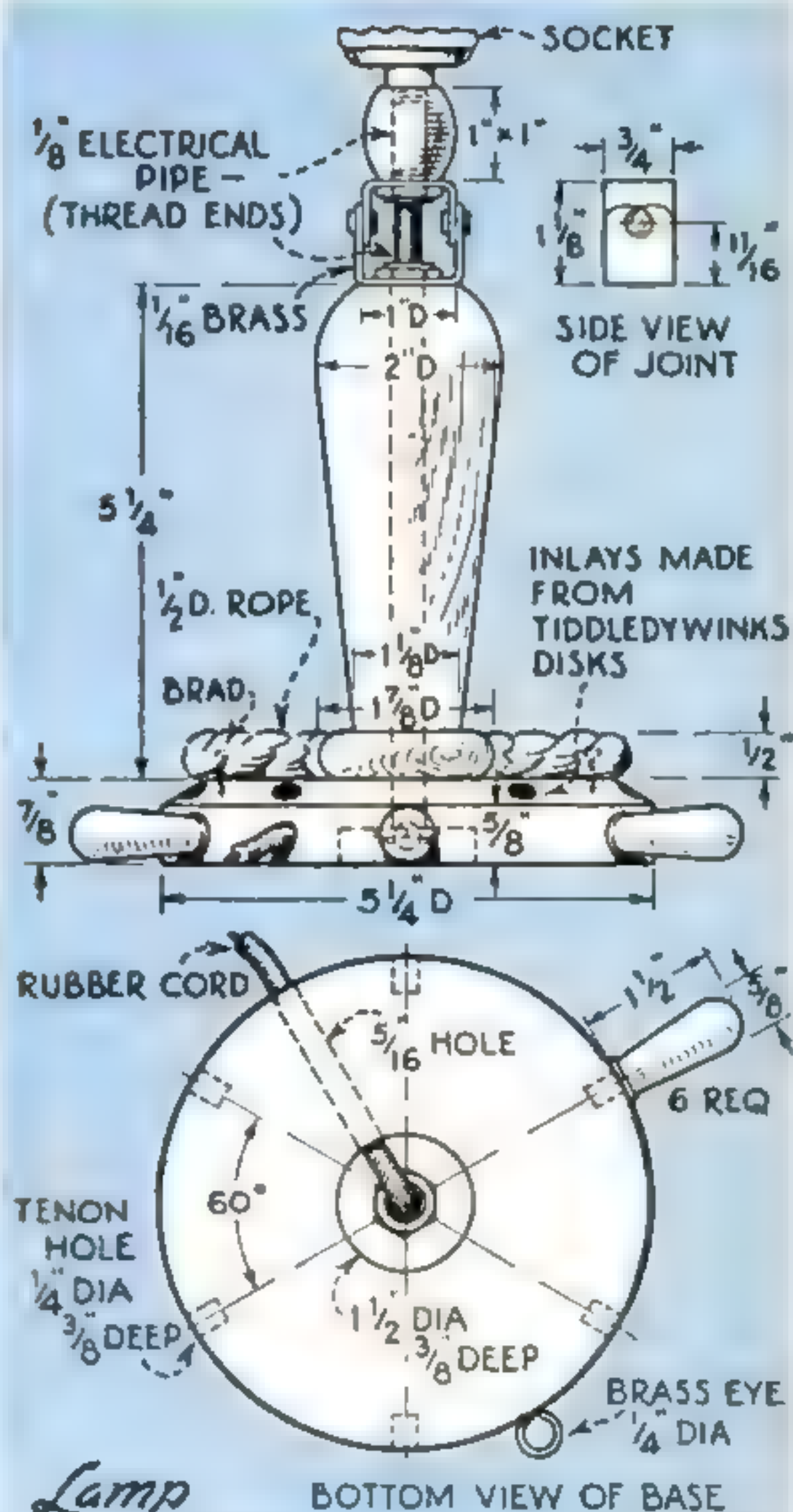
THE honest aroma of tarred hemp rope emphasizes the nautical design of this lamp and ash tray. The lamp has a special joint that permits it to be used either on the table or on the wall as a "pin-up" fixture. Both pieces are made of maple.

Although the drawings are practically self-explanatory, a few hints may be helpful. The joint of the lamp is made from sheet-brass stock, riveted to give a firm swinging fit. The parts of the lamp are held securely together with nuts on the ends of the $\frac{1}{8}$ " electrical pipe. The small turning that conceals the pipe nipple between the socket and the joint must be drilled with caution in the lathe to avoid splitting it. Turn the spokes from one piece of stock and make this small connector with the same set-up. Sand all parts well.

The disks used in playing tiddledywinks make good inlays, and the recesses for them are bored. The rope ring is secured with brads, and the joint where the ends are butted together is wrapped with white adhesive tape to look like canvas.

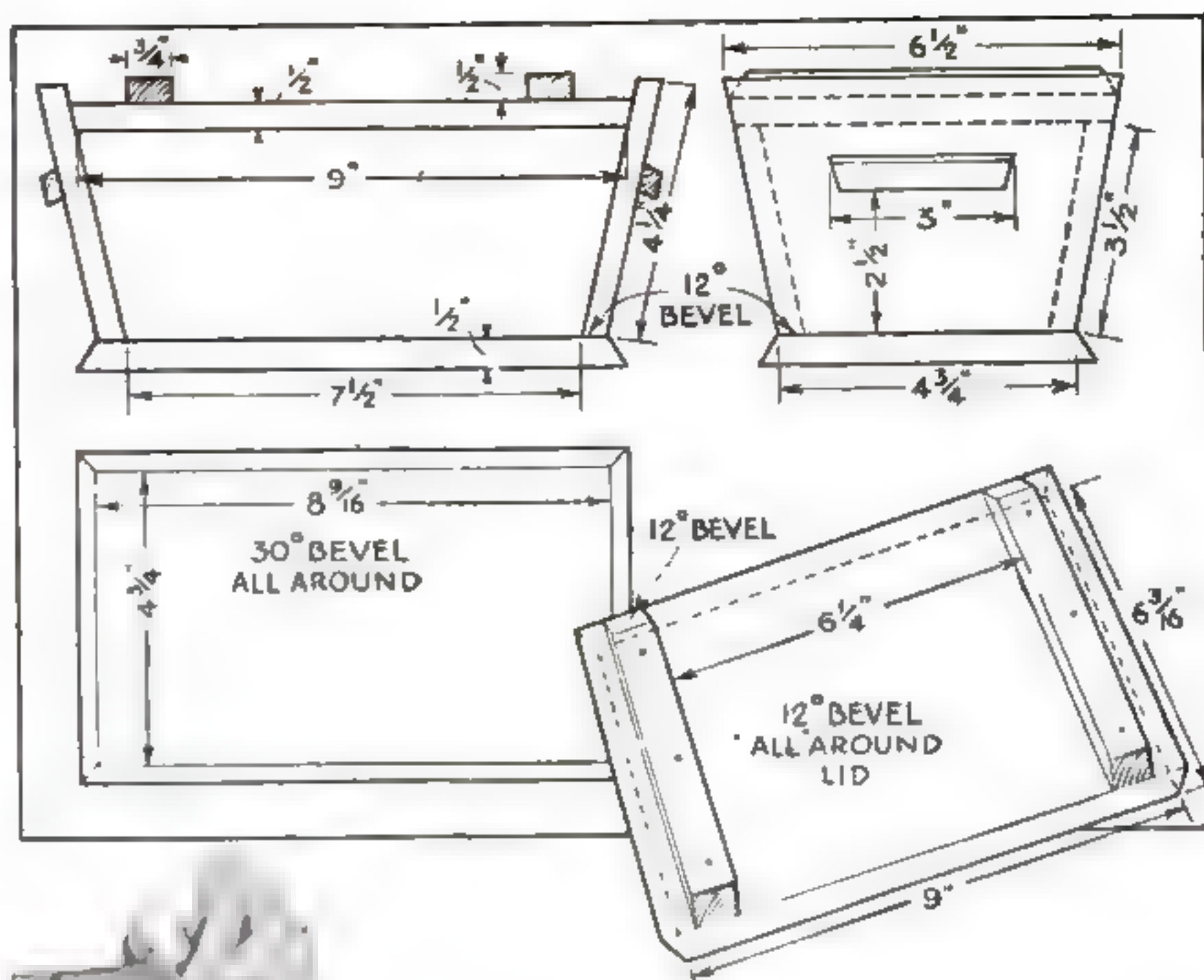
The spokes and cigarette holder of the ash tray are turned from one piece of stock. The base is a faceplate operation, the recess being turned to fit whatever tray it is desired to use. The match holder is shaped on the jig saw, and the slot cut with the circular saw. In attaching the rope under the base, drive the nails well into the fibers.

Both projects may be stained any desired tone of maple and finished in the usual way. The rope, of course, should be left a natural color. —BRUCE MACINTOSH.



The lamp and, left, the ash tray with details of cigarette rest and match holder. The finished pieces are illustrated in photos above

Copied from an authentic colonial dough tray, this scale model acts as a unique table container for cookies or hot rolls and muffins



Miniature Dough Tray Keeps Muffins Hot

A FAMILIAR sight in early American kitchens was the dough tray. When reproduced in miniature size, one of these curious old boxes will serve as a table container for keeping rolls and muffins hot, or for holding cookies or tea wafers.

The design shown is a scale model of a dough tray used by the writer's grandmother and is typical of those found in the kitchens of the German families of Eastern Pennsylvania before the days of the community baker.

The model is constructed from 1/2" poplar

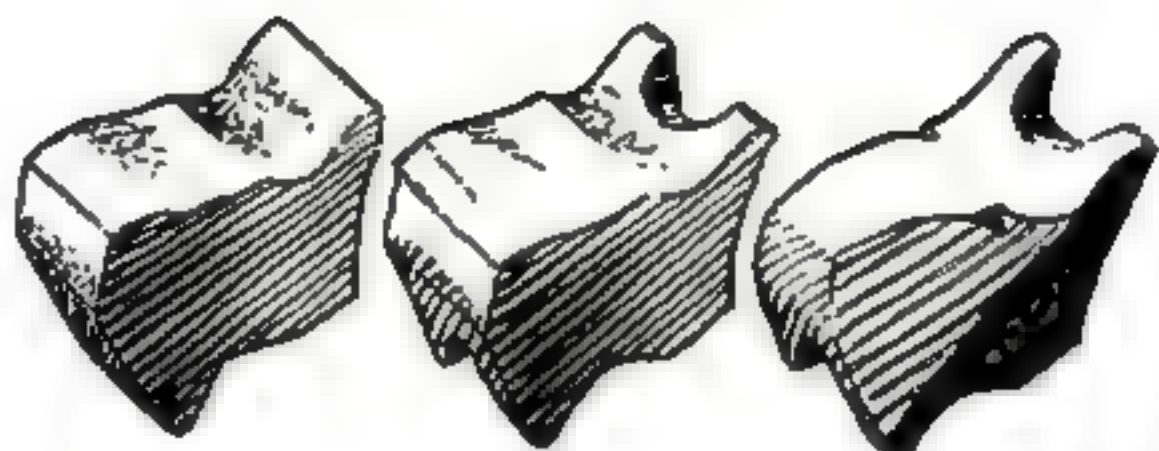
and fastened with wire brads. In the original, however, the corners were accurately dovetailed together, and this type of joint may be used by those who are willing to undertake the extra work. The angle for the sides of the tray, the lid, and the handles is 12 deg.

After the tray is assembled, smooth off all the sharp edges with fine sandpaper. Stain the wood a light brown to give it an antique appearance, and finish with several coats of clear lacquer or varnish, rubbed down to a dull finish.—GEORGE A. SMITH.

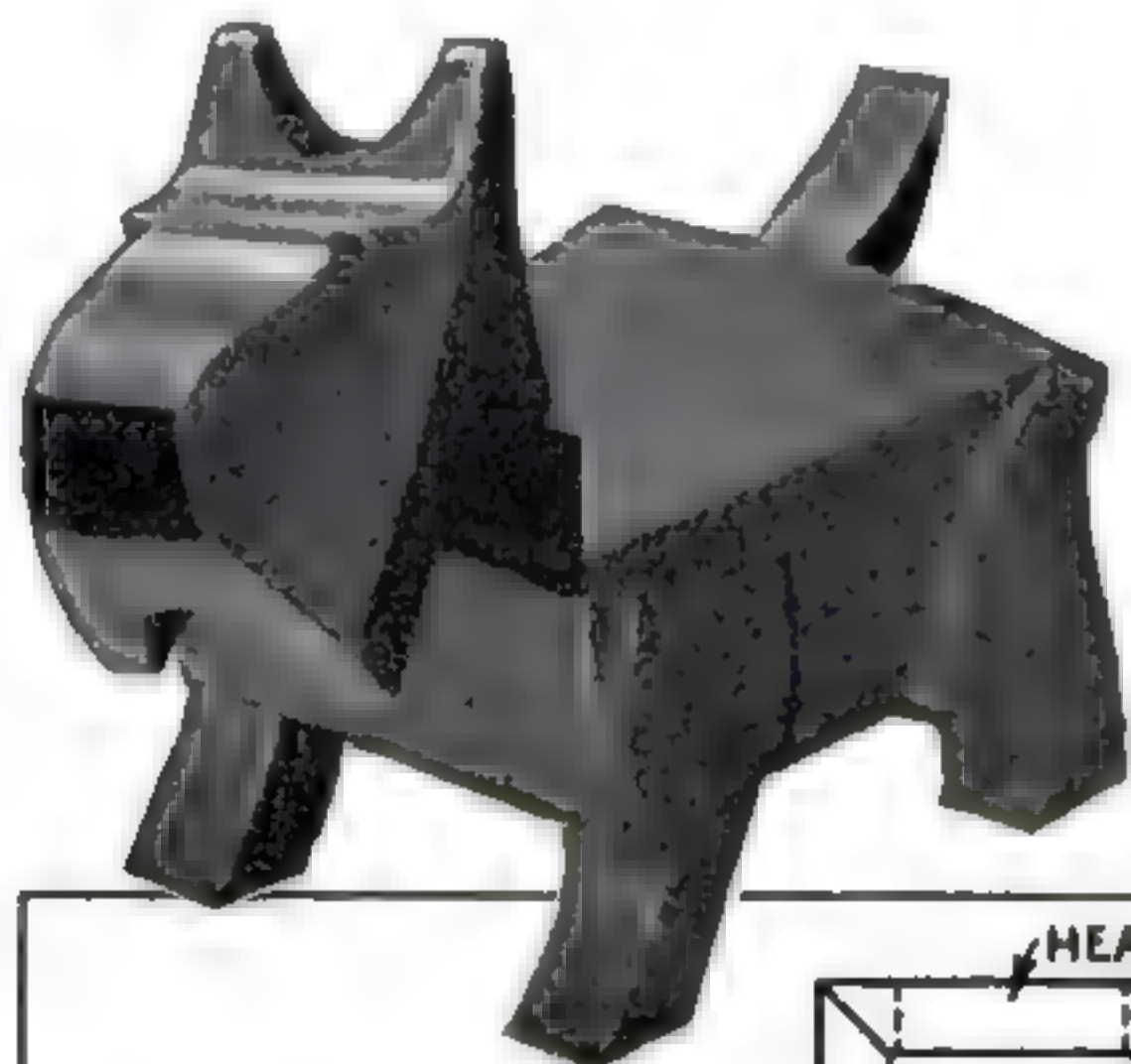
Brightly-Colored Rack Holds Spices or Crackers



THE length of this simple project determines its use. When 4" long it makes a spice rack; elongated, it becomes a cracker tray. Use 1/64" sheet iron 2 3/4" wide and as long as desired. Bend 90 deg. to form a V. Cut two disks 2 1/2" in diameter from 1/4" plywood. Saw one disk in half for the end pieces and the other in quarters. Fit one of the quarters in each end of the V, and drive small finishing nails through the metal into the wood. Then nail on the half segments. Sandpaper the completed rack and enamel a bright color.—WALTER F. DEBOLD.



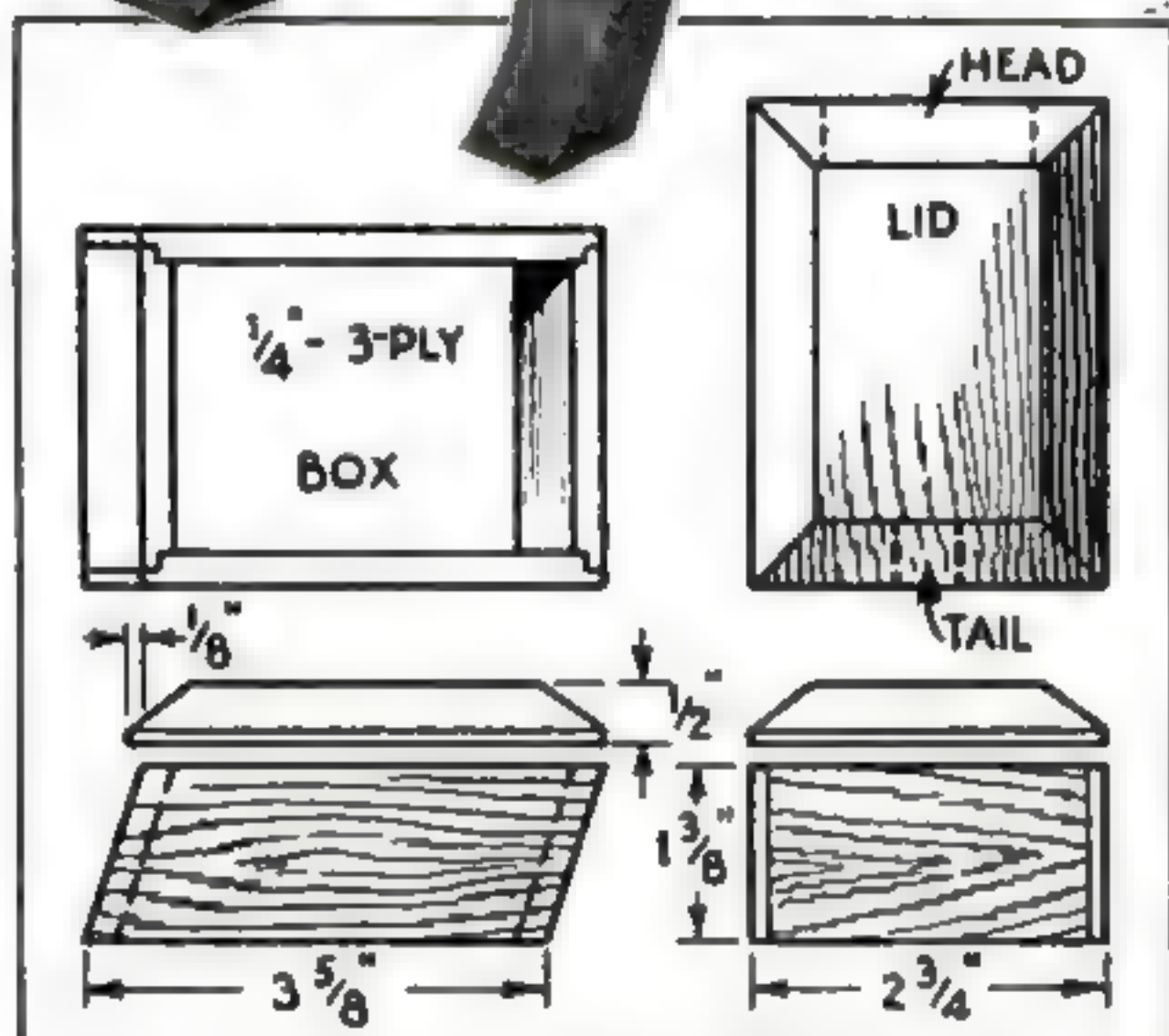
Above, steps in shaping the head from a dressed pine "two by two." Right, the Scottie in use. Below, a close-up of the box when closed



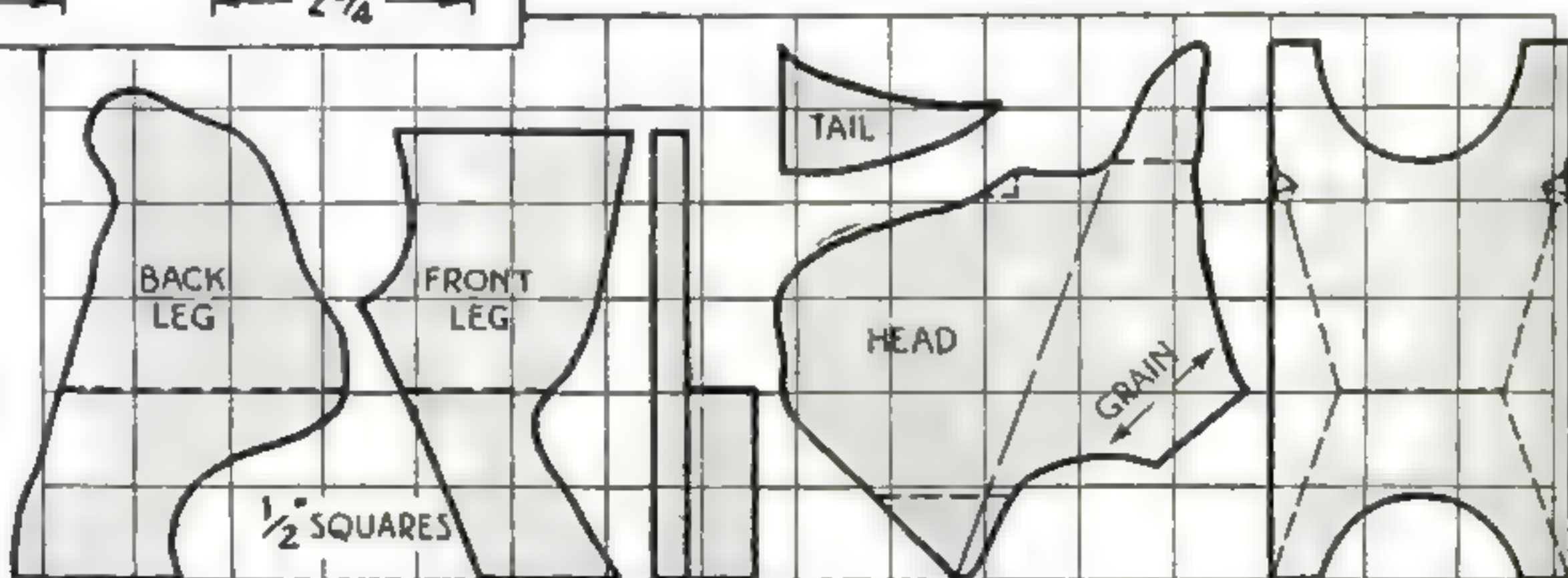
Scottie Cigarette Box Opens When Tail Is Pressed

BECAUSE of its simplicity, this novel Scottie box for trinkets or cigarettes is well suited to quantity production. The lid is raised by pressure on the tail.

The body and legs are made from $\frac{1}{4}$ " plywood, the tail and lid from $\frac{1}{2}$ " stock, and the head is cut from a dressed pine "two by two," which actually measures about $1\frac{5}{8}$ " square. It will be noted that no hinge is required since the lid is pivoted on two small brads. For greater speed in production the thickening blocks on the inner side of the legs may be omitted, if desired. The boxes illustrated were finished with enamel.—R. O. LISSAMAN.



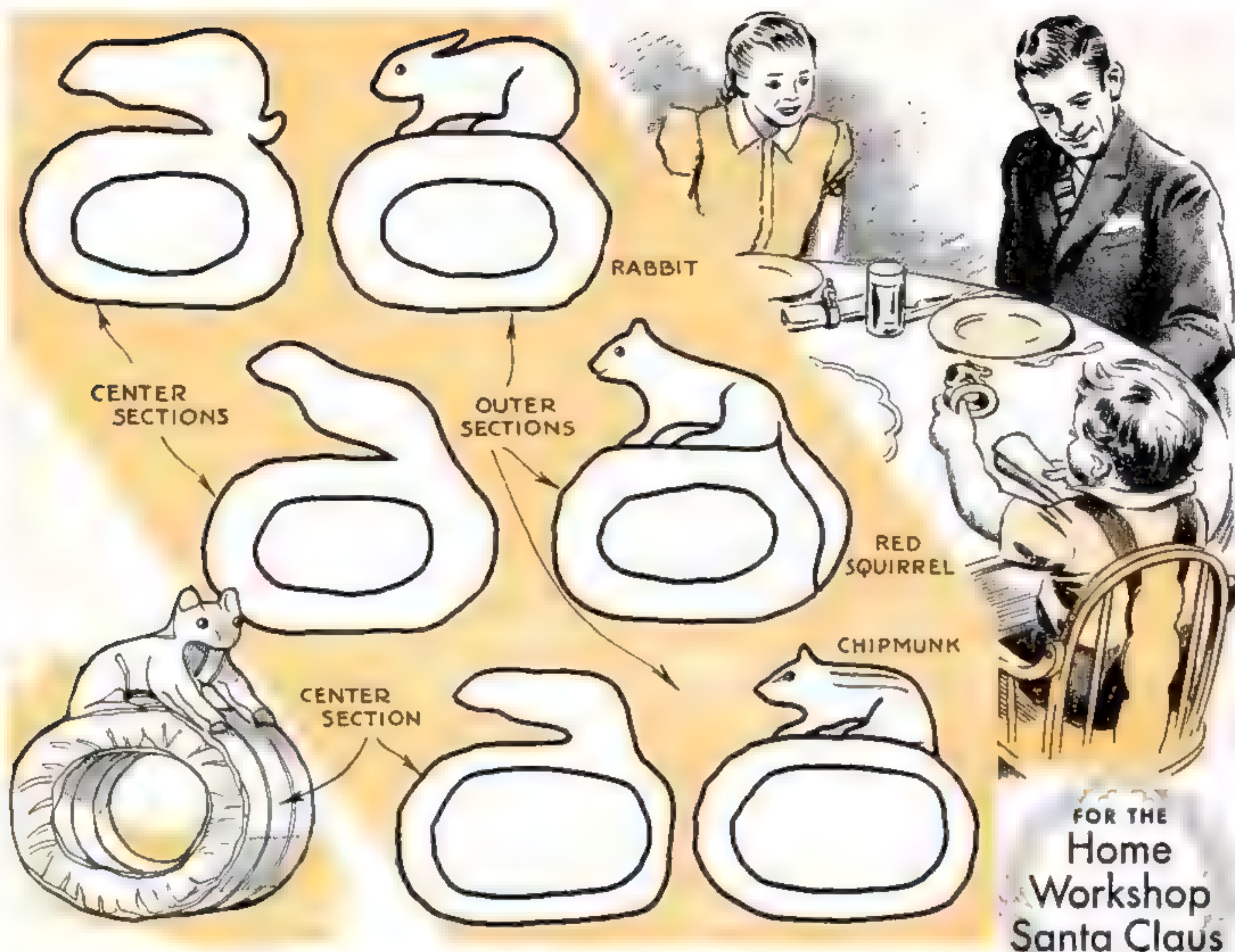
Drawings of the box. At right, shapes of the pieces fastened to body of dog



Pumice Stone and Enamel Form Blackboard Paint

CHILDREN often appreciate a simple blackboard at Christmas as much as an expensive gift. When ready-mixed commercial blackboard paint cannot readily be obtained at a local paint or hardware store, a substitute can be prepared by adding a small amount of powdered pumice stone to black enamel. Apply two fairly heavy coats to any

smooth material such as plywood or pressed composition wood. Let each coat dry thoroughly and wash the surface with cold water before it is used for the first time. Complete the blackboard by making a simple frame for it. The board may be placed on an easel or hung on the wall. Attach screw eyes if it is to be hung.—T. G. HETRICK.



Woodland Animals Adorn Napkin Rings

ANIMAL napkin rings make an immediate hit with children, and with their elders, too. One of the rings, you will notice, has a larger opening for an adult-size napkin. The drawings are half size.

The construction for the three—red squirrel, rabbit, and chipmunk—is the same. Cut out three sections of two-ply wood (made by yourself with casein glue and $\frac{1}{8}$ " gumwood) on a jig saw for each ring. Glue together and leave in a press overnight. It is best to fasten the sections temporarily with small brads to prevent slipping.

Remove the nails next morning and shape the animals by hand or with rotating files and dental burrs held in a motor-driven chuck. Drill holes for the eyes, and insert small black glass-headed pins after cutting all but $\frac{1}{8}$ " off of the shank and filling the holes with waterproof glue.

Use red mahogany stain for the red squirrel and chipmunk; also black ink for the tail and stripes of the latter. Light oak stain is suitable for the cottontail. Throats, stomachs, and two of the chipmunk's stripes are left natural.—EDWARD B. FOX.

Lively Squirrels Bound Alongside a Toy Cart

PULLED along the floor with a string, this cart rides steadily on three small wheels while the squirrel at each side of it jumps along in a lively manner. Large eccentric wheels fastened to the squirrels, but not to the cart, cause this movement.

Cut all the parts including the wheels from $\frac{1}{2}$ " wood and cut lengths of $\frac{1}{2}$ " dowels for the axles. The two large wheels are 4" in diameter and the three small wheels 2" in diameter. Drill $\frac{5}{8}$ " holes in them as indicated and $\frac{1}{2}$ " holes in the

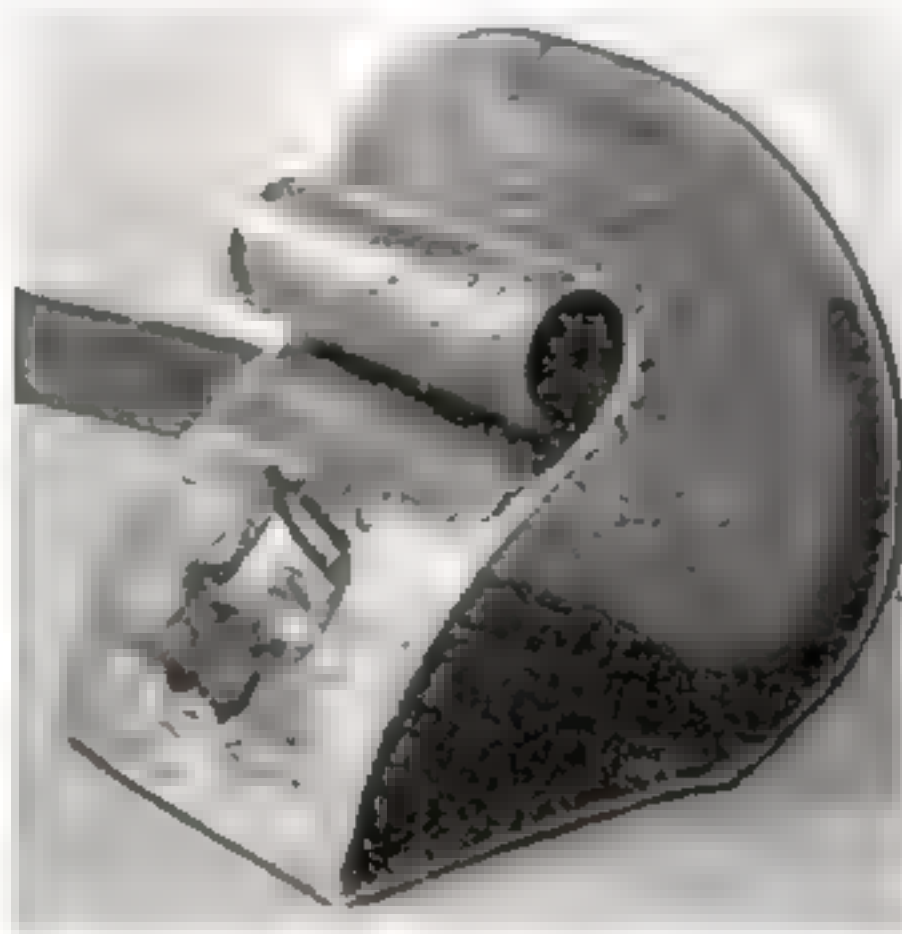
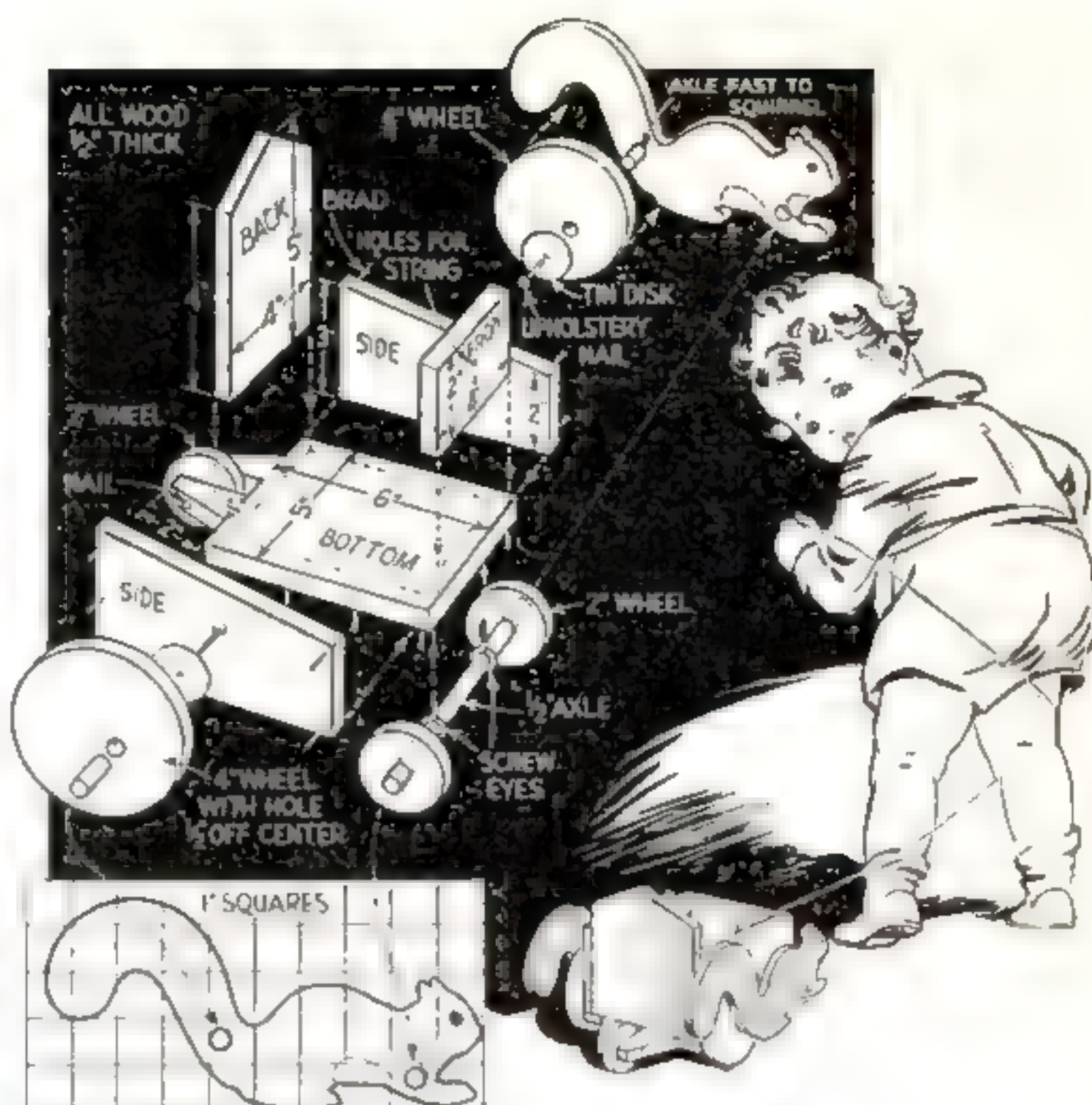
squirrels. Axles for the eccentric wheels are each $1\frac{1}{8}$ " long; the main axle is $7\frac{1}{2}$ " long. Note that the top of the front piece must be beveled so it is in the same plane as the sloping sides.

Fasten the four sides of the cart together with slender brads; then nail the bottom to them. Drill two small holes in the front of the cart for the cord. The rear wheel may now be mounted between the two projections on the back of the cart by using a nail for an axle.

Put a short wooden rear axle in the hole through the tail of each squirrel and fasten it with two slender brads from the under edge of the squirrel. Place one of the eccentric wheels on each axle and hold it with a flathead upholstery nail and a disk of stiff tin.

Drive two substantial $\frac{1}{2}$ " screw eyes under the front of the cart. Cut two notches around the front axle to fit in them; then force the $\frac{1}{2}$ " front axle through the screw eyes till the notches engage them. This will allow the axle to turn freely. Next add a small wheel on each end of this axle and then a squirrel. Drive two brads from the under edge of each squirrel into the dowel.

The squirrels should be painted brown with pale patches underneath, and the cart and the wheels given one or two bright colors.—HAZEL F. SHOWALTER.

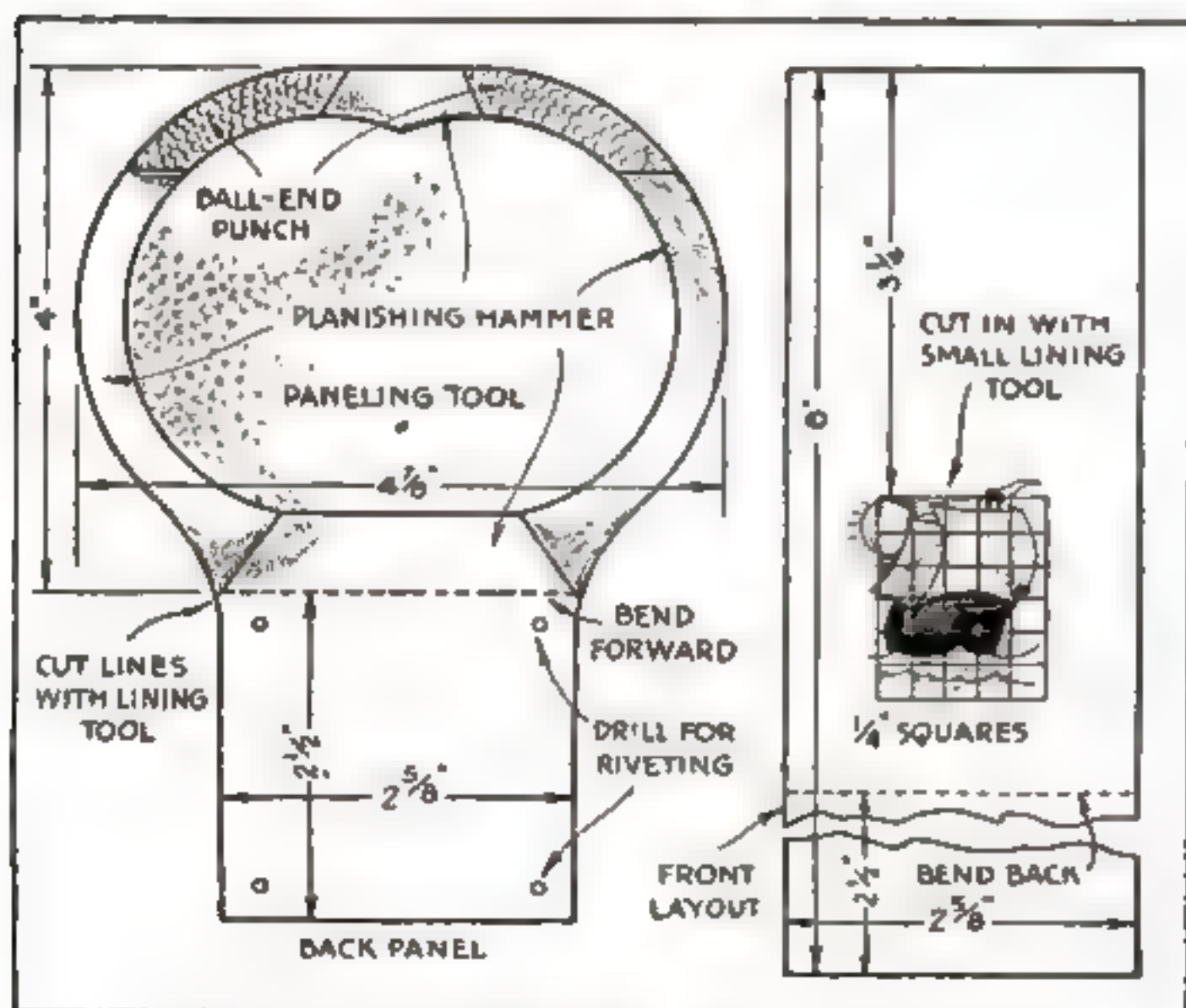


Novel Stationery Holder Hammered from Copper

THE base and back panel of this decorative stationery holder is 18-gauge sheet copper, lined and hammered. The front, which is 22-gauge copper is well hammered with a planishing hammer for smoothness and to make the material springy.

A ship, Scottie, or any ornamental figure may be applied to the front. First lay out the design on paper, then transfer it to the metal. In the case of the ship design illustrated, the hull was embossed with a flat-end punch, and all the other work was done with a small lining punch.

Bend the piece to shape and rivet it to the base. Clean the holder thoroughly. Immerse it in a solution of liver of sulphur until the metal turns a dark brown; then wash, dry, burnish the high lights, and polish and lacquer the piece.—DICK HUTCHINSON.



To mark the ship design, use a small lining punch as in the upper right-hand photograph

COPPER TRIMMED Fireplace

OF MODERN
DESIGN

By
W. Stanton Hills

Painted a rich, dark red, the bookshelves and fire pit are in striking contrast to the white finish of the fireplace



THIS modern fireplace can be constructed by the average craftsman without the use of power tools. Besides being an ornament, it has shelves for books, and space has also been allotted for the installation of a radio, if desired.

The hearth *A* is a piece of five-ply veneer on which are glued and screwed blocks *B*, *C*, *D*, and *N*. *B* and *C* are $\frac{1}{2}$ " wider in the rear than in the front. This is to allow the waste piece of three-ply veneer that is cut from the front to be used for the backing of the pit. The six identical pieces *D* are cut on a radius of 12". *N* and *D* should be fastened to the base after uprights *L* and *O* are in position. *F* and *J* follow; then *I* is placed on top of *F*, *J*, *L*, and *O*. Fastening is done with finishing nails and casein glue.

The two uprights *K* forming the sides of

the pit are fastened to the base blocks, and *M* is fastened on top of *K*. Braces *G* are put in positions to give the best support for the veneer in front. Pieces *D* are then fastened. Strip *P* may next be secured to the top, and we are then ready to place the finishing piece of veneer on the front.

The holes in the veneer that are to line up with the fire pit and the two bookshelves must be cut by measuring the distance between upright *J* and upright *K*, then measuring from *K* to *K* and from *A* to *M*. When this piece is sawed out, it should be cut slightly smaller than the finished space will be. The same procedure is followed for the pieces that are cut out for the bookshelves.

The fireplace is laid flat on its back, and the veneer fastened to the end upright *J* with casein glue and 1" No. 10 brads. The glue is spread on the edges of the supports

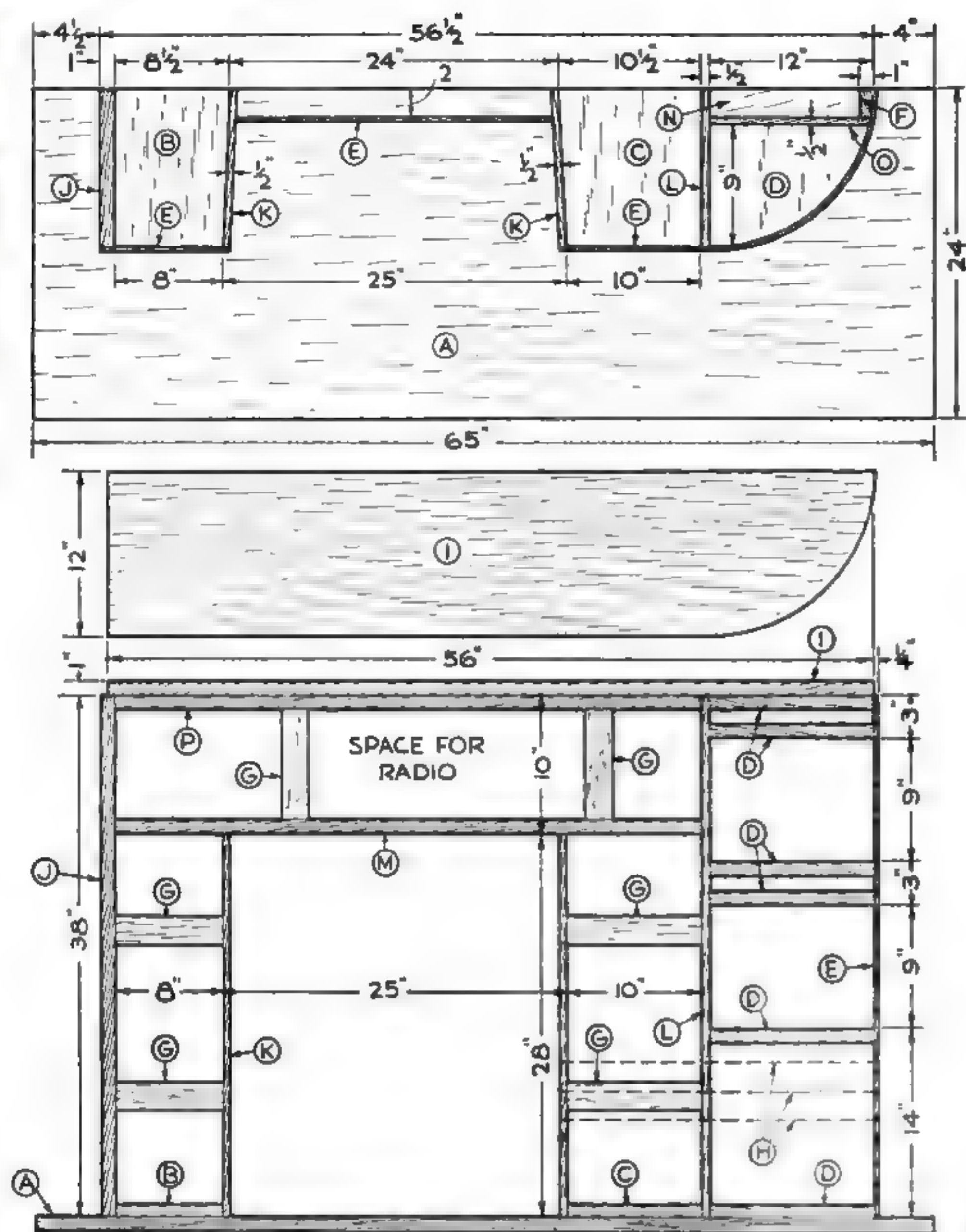
LIST OF MATERIALS FOR MODERN FIREPLACE

Mark No.	T.	W.	L.	Description
A	1	24	65	5-ply basswood
B	1	8½	12	white pine
C	1	10½	12	" "
D	6	9	12	5-ply basswood
E	1	¾	38	3-ply basswood
F	1	2	38	white pine
G	6	2	60	strips for bracing
H	3	15 ga.	1	copper strips
I	1	12	56	5-ply basswood
J	1	12	38	" "
K	2	½	28	white pine
L	1	½	38	" "

Mark No.	T.	W.	L.	Description
M	1	12	43	white pine
N	1	2	11	" "
O	1	½	38	" "
P	1	2	43	" "

Nails, screws, glue, and paint.

NOTE: All dimensions are given in inches. All pieces of 5-ply basswood can be cut from 2 pc. 1" by 24" by 84". The ¾" by 38" by 72" panel *E* must have the grain running the short way, which will make it necessary to purchase a larger panel. This size is sometimes referred to as theatrical panels. In place of this, ½" pressed composition board of tempered quality may be used.

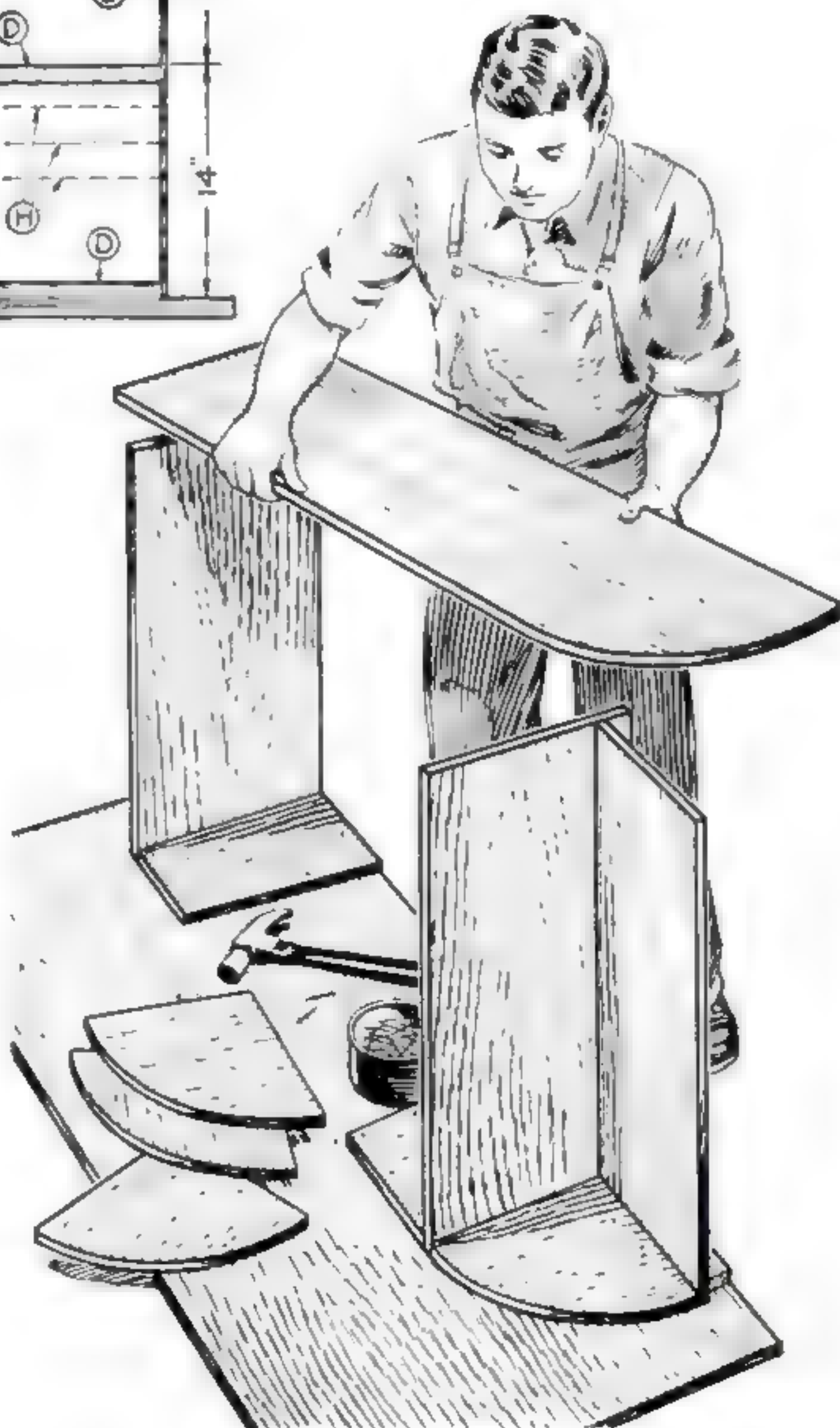


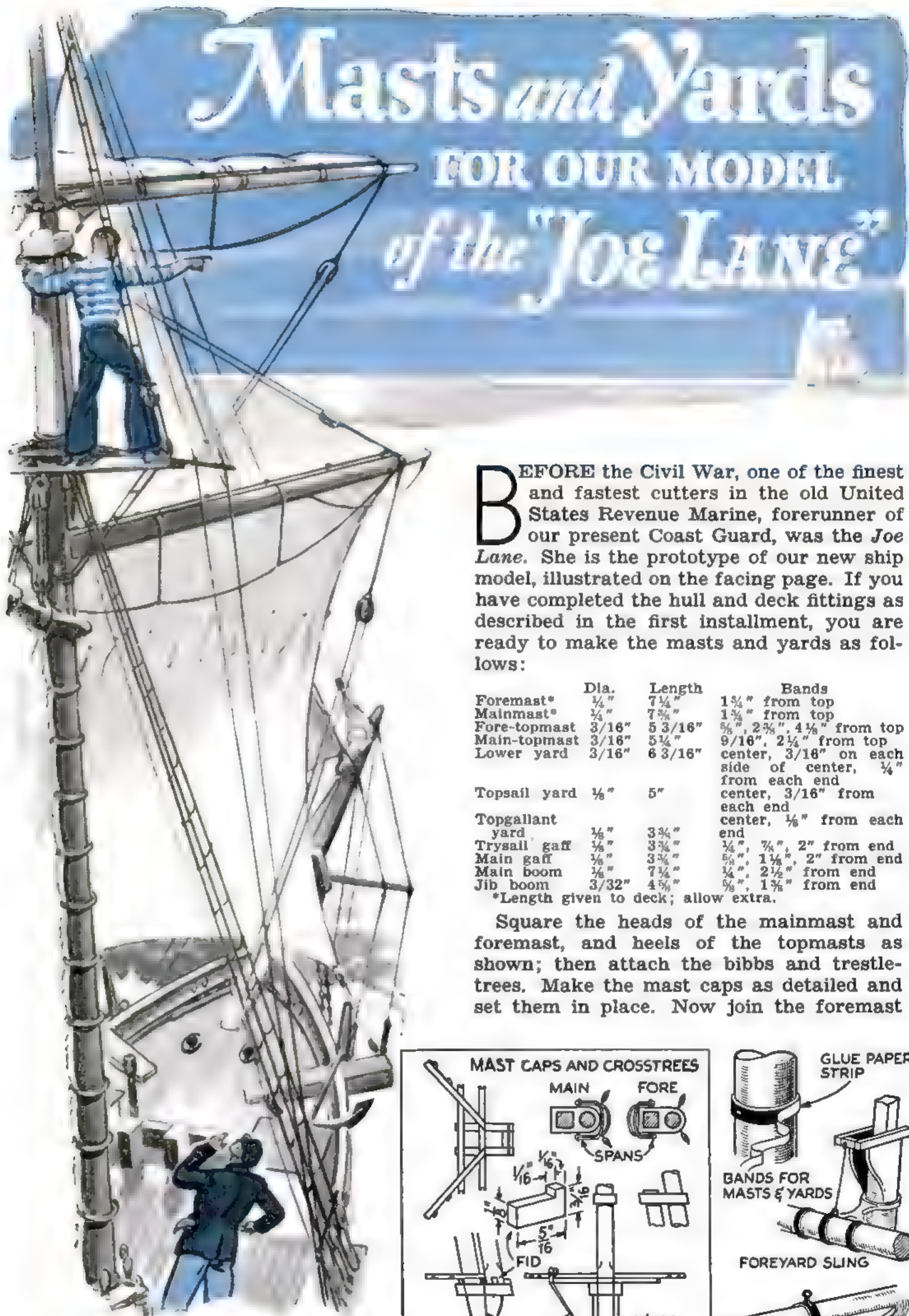
After the parts have been cut to the dimensions given in the list on the facing page, they are assembled as shown in the drawings at the left. Each bears an identifying letter

from upright *J* to upright *L*, but not on the curved section. After all this is fastened, the curved section is glued, and the veneer is eased around the curve, clamped, and nailed.

After being sandpapered, the whole fireplace is given a coat of shellac. When dry, it is sanded lightly with 4/0 sandpaper and given two coats of flat and two coats of semigloss white paint. Sand again before each new coat of paint is applied. When this is dry, two coats of dark red paint are applied to the bookshelves and the fire pit.

The copper strips *H* are made by cutting into three strips a piece of 15-gauge copper, 3" wide and 30" long. Polish the metal with very fine steel wool and fasten it on by nailing at both ends with roundheaded copper nails. The strips are then lacquered to preserve their luster. Two coats of black paint and one of wax are applied to the hearth. Notch out the rear of the fireplace at the bottom for the baseboard molding.





Masts and Yards

FOR OUR MODEL

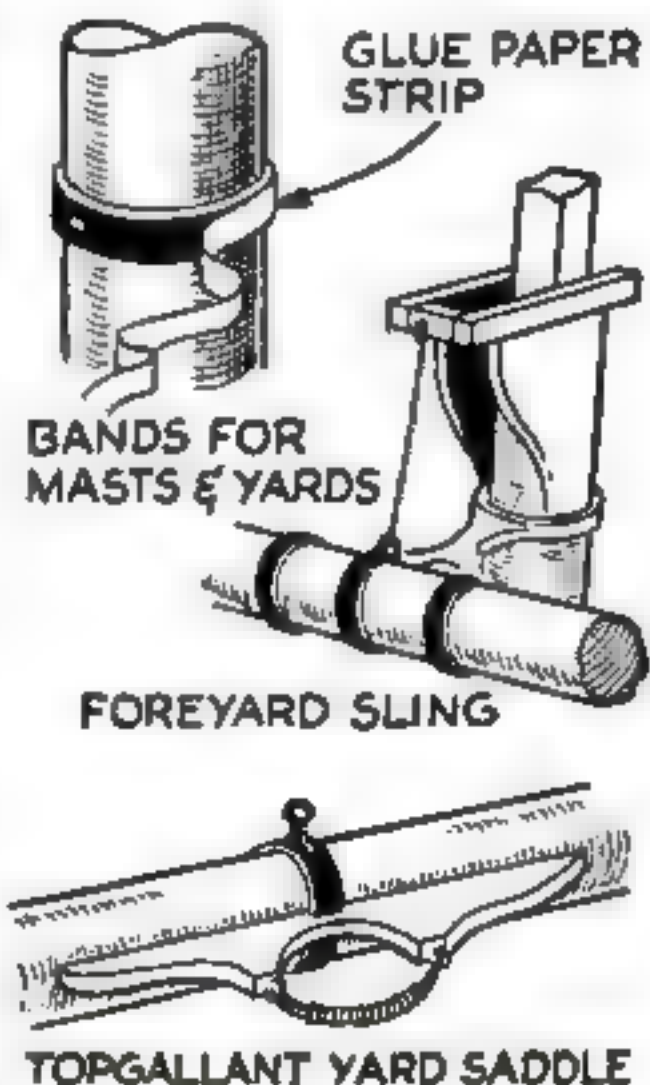
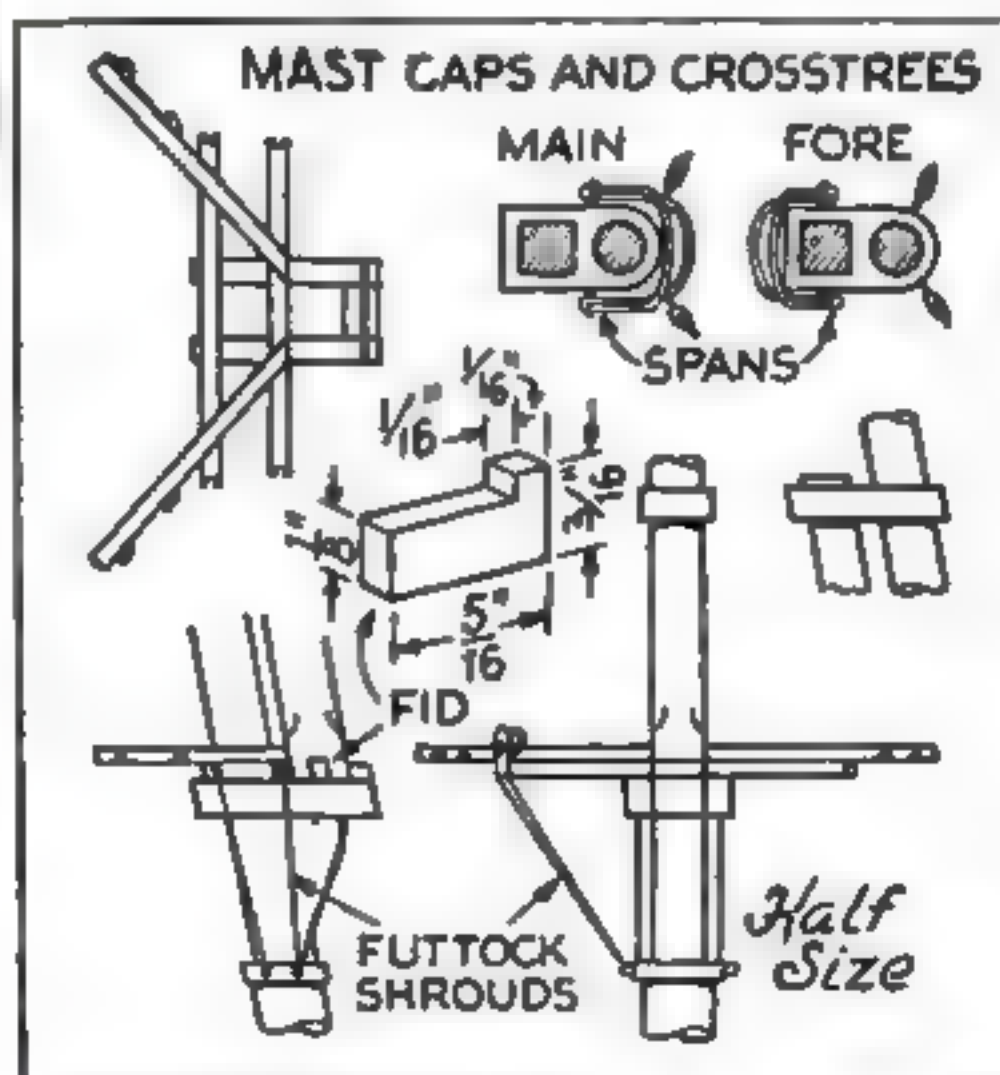
of the "Joe Lane"

BEFORE the Civil War, one of the finest and fastest cutters in the old United States Revenue Marine, forerunner of our present Coast Guard, was the *Joe Lane*. She is the prototype of our new ship model, illustrated on the facing page. If you have completed the hull and deck fittings as described in the first installment, you are ready to make the masts and yards as follows:

	Dia.	Length	Bands
Foremast*	$\frac{1}{4}$ "	$7\frac{1}{4}$ "	$1\frac{1}{4}$ " from top
Mainmast*	$\frac{1}{4}$ "	$7\frac{1}{4}$ "	$1\frac{1}{4}$ " from top
Fore-topmast	$\frac{3}{16}$ "	$5\frac{3}{16}$ "	$\frac{5}{8}$ ", $2\frac{3}{8}$ ", $4\frac{1}{8}$ " from top
Main-topmast	$\frac{3}{16}$ "	$5\frac{1}{4}$ "	$\frac{9}{16}$ ", $2\frac{1}{4}$ " from top
Lower yard	$\frac{3}{16}$ "	$6\frac{3}{16}$ "	center, $\frac{3}{16}$ " on each side of center, $\frac{1}{4}$ " from each end
Topsail yard	$\frac{1}{8}$ "	5"	center, $\frac{3}{16}$ " from each end
Topgallant yard	$\frac{1}{8}$ "	$3\frac{3}{4}$ "	center, $\frac{1}{8}$ " from each end
Trysail gaff	$\frac{1}{8}$ "	$3\frac{3}{4}$ "	$\frac{1}{8}$ ", $\frac{7}{8}$ ", 2" from end
Main gaff	$\frac{1}{8}$ "	$3\frac{3}{4}$ "	$\frac{5}{8}$ ", $1\frac{1}{8}$ ", 2" from end
Main boom	$\frac{1}{8}$ "	$7\frac{1}{4}$ "	$\frac{1}{4}$ ", $2\frac{1}{2}$ " from end
Jib boom	$\frac{3}{32}$ "	$4\frac{1}{8}$ "	$\frac{5}{8}$ ", $1\frac{1}{8}$ " from end

*Length given to deck; allow extra.

Square the heads of the mainmast and foremast, and heels of the topmasts as shown; then attach the bibbs and trestle-trees. Make the mast caps as detailed and set them in place. Now join the foremast



with the fore-topmast, and the mainmast with the main-topmast.

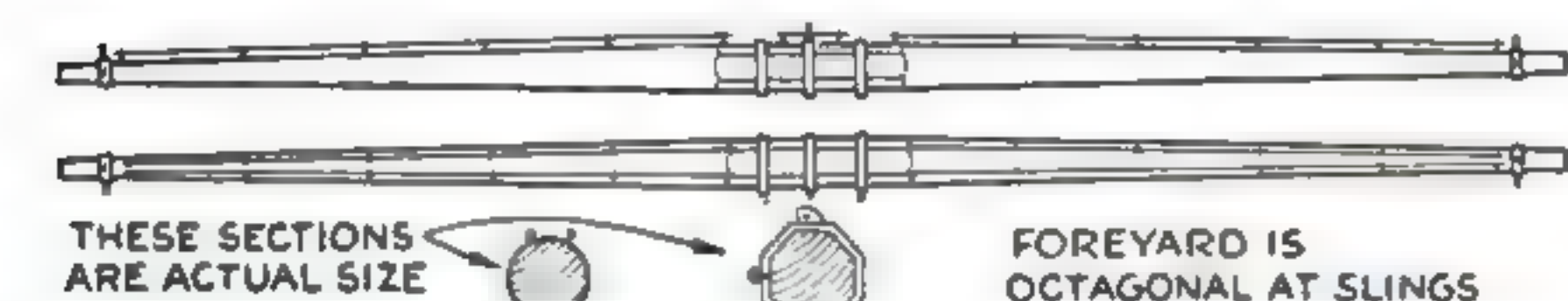
Next make the yards, gaffs, and booms, tapering the ends to 1/16". Note the form of the gaff and boom jaws. Drill holes for all jackstays and put the jackstays on the yards in their correct places. As you complete these parts, shellac and paint them according to the chart previously given, and set them aside to dry. Continue by making the bands for the yards and masts from strips of paper 1/16" wide. Shape two circles of thin wood 9/16" in outside diameter for the fife rails, drill holes for the belaying pins, and fasten the rails onto the masts 3/8" above

the deck line. Cut out the cap and bee seats for the bowsprit and fasten in place; then make the whisker booms.

Drill holes in the cap rail with a No. 65 drill for the belaying pins in the places marked on the deck plan given previously.

The masts have a rake of 10 deg. which can be determined with a protractor or by drawing a right triangle with sides of 1" and 5". When drilling the holes for the masts, make them a trifle large so that the slant may be adjusted if necessary. Do not set the masts into the holes at this point, but lay aside until the rigging is started.

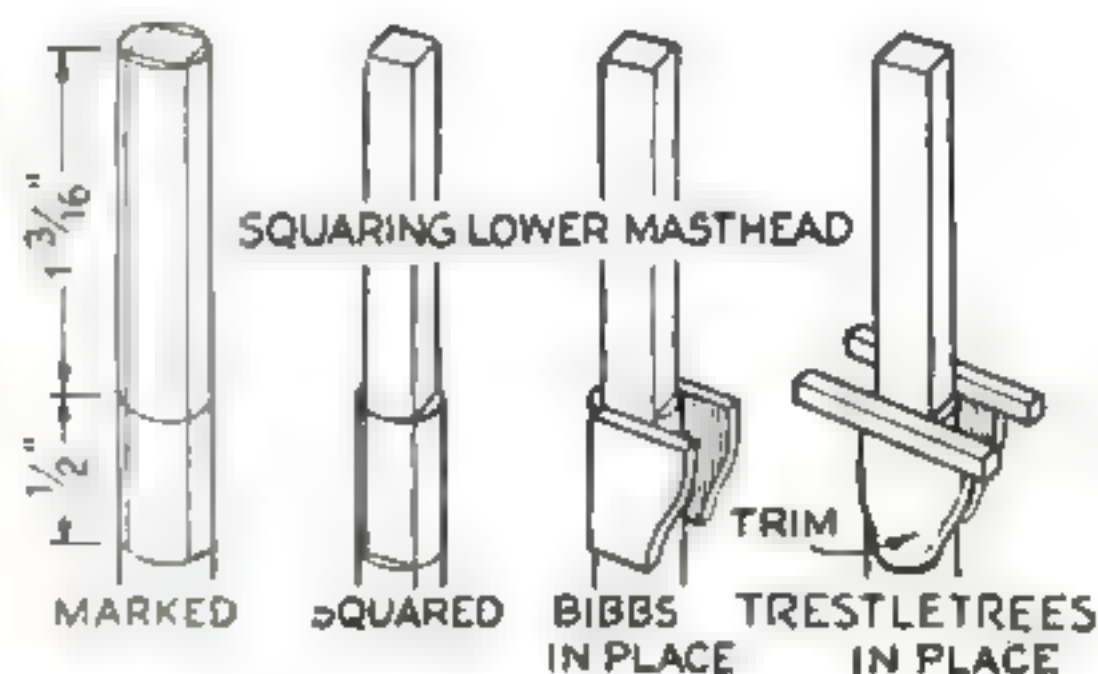
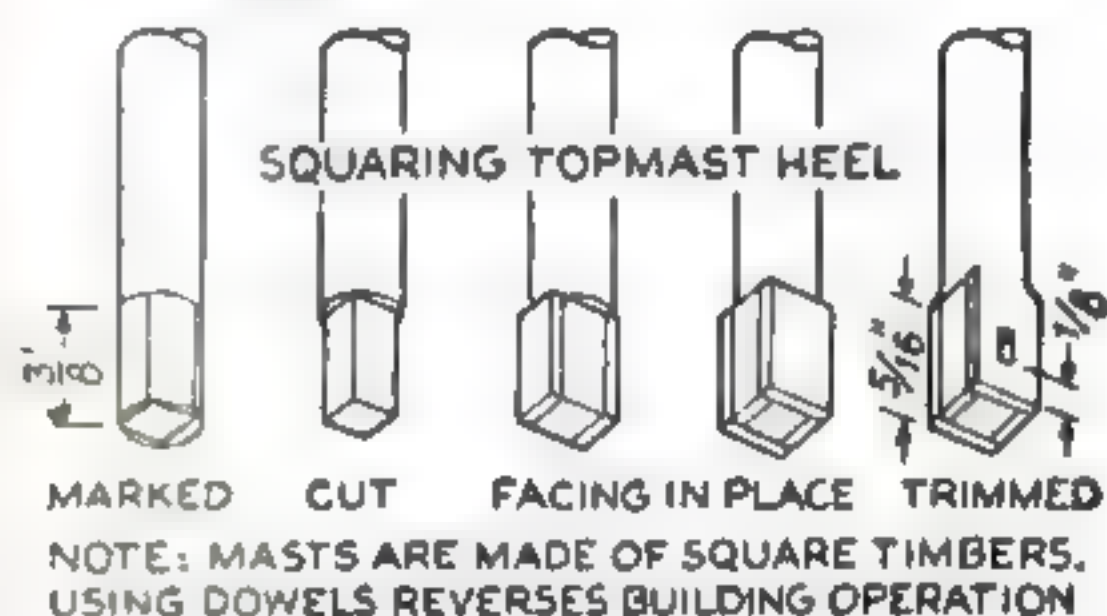
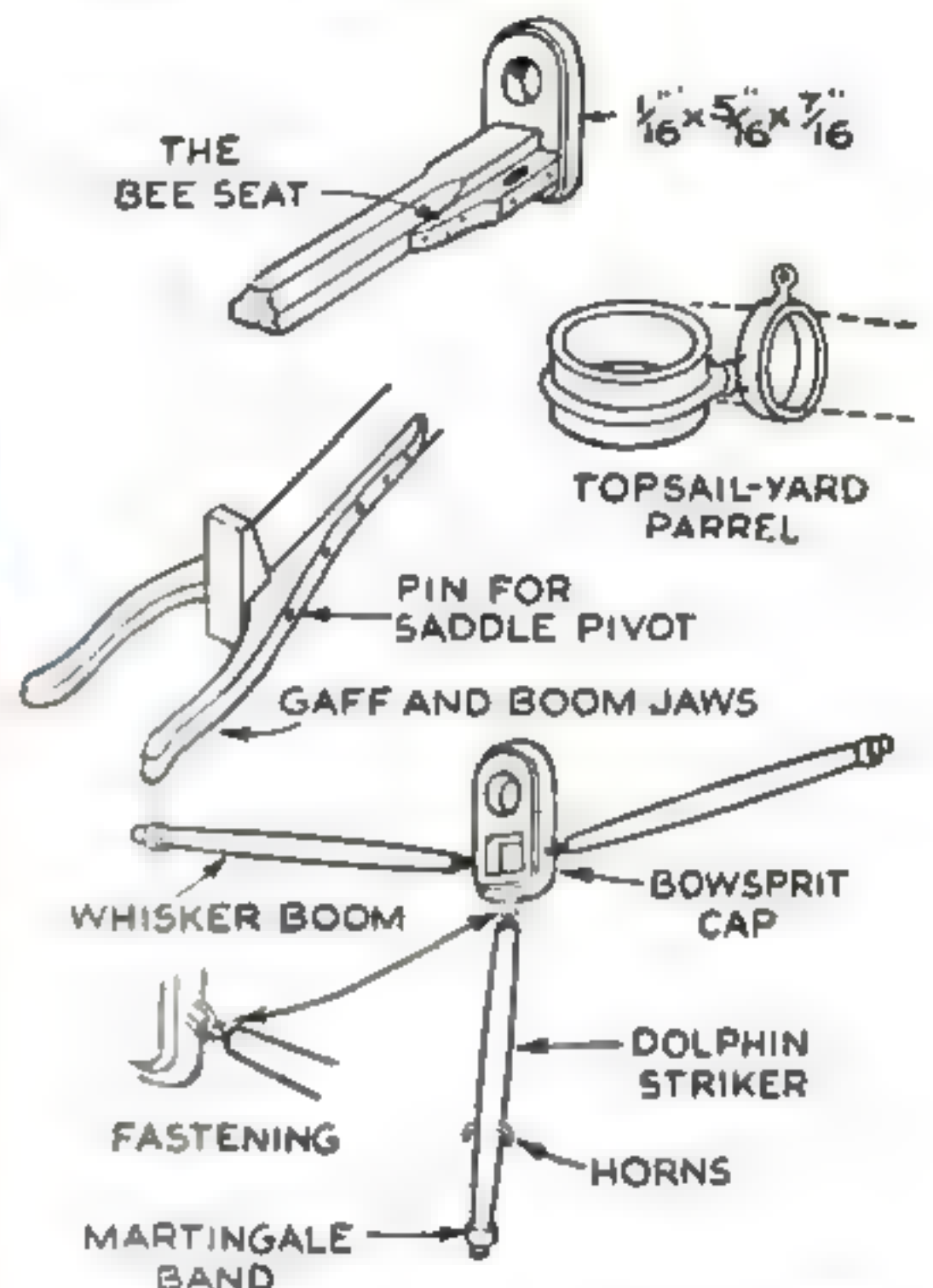
(TO BE CONCLUDED)



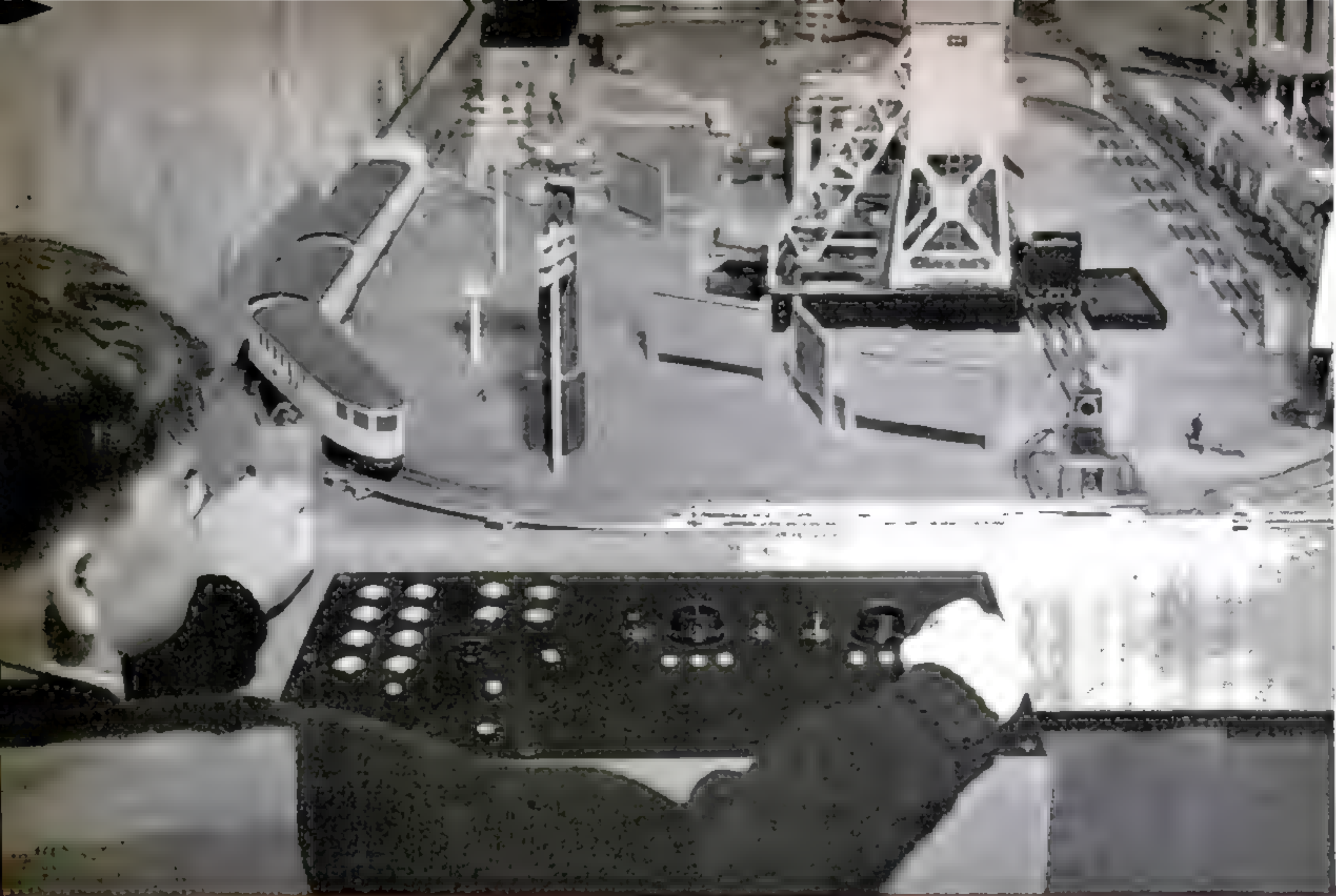
TOPSAIL AND TOPGALLANT YARDS ARE ROUND. DOUBLE JACKSTAYS ON LOWER AND TOPSAIL YARDS. SINGLE JACKSTAYS ON TOPGALLANT.



The completed model is 21" in length and 13" high over all. This is an excellent size for the mantelpiece



By
**EMANUELE
STIERI**



Simplified Switchboard

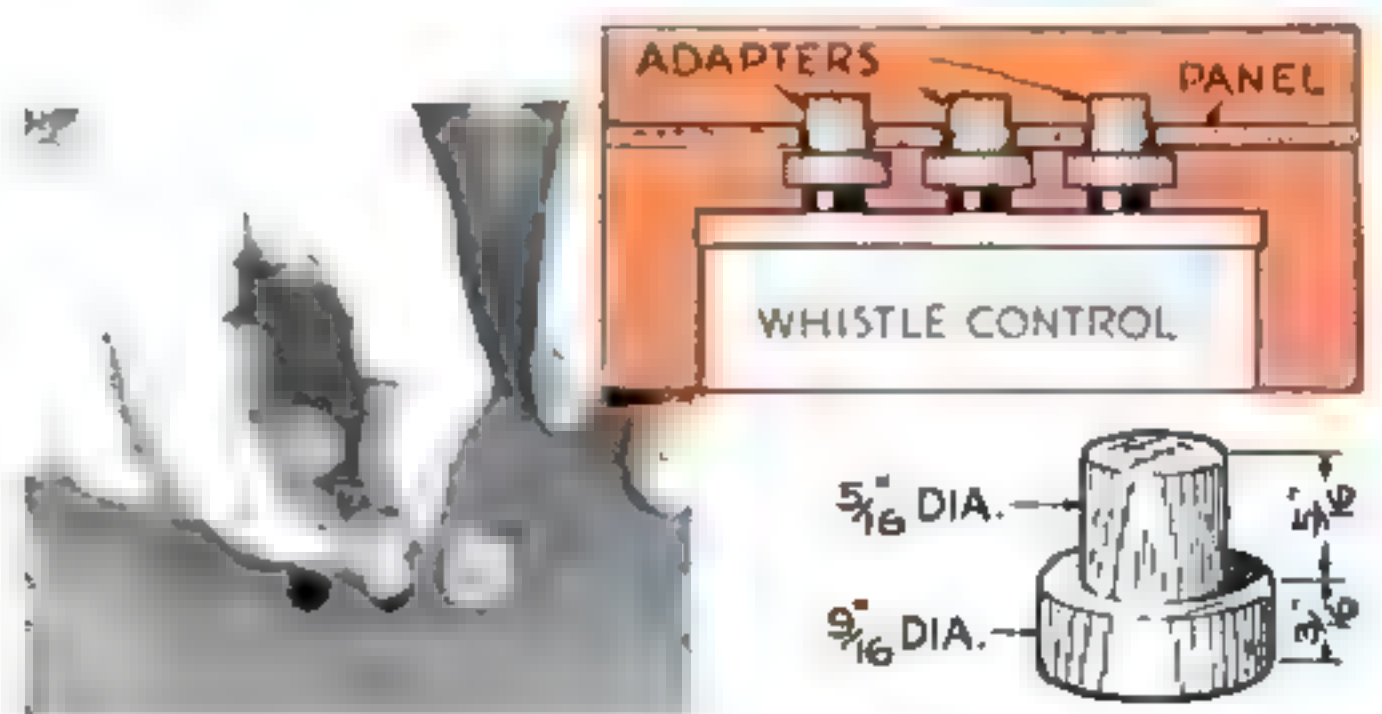
CONTROLS MODEL RAILWAY SYSTEM

ADAPTABLE to any size model-railway system, this switchboard groups all the controls at your finger tips so you can execute the most difficult train movement with ease.

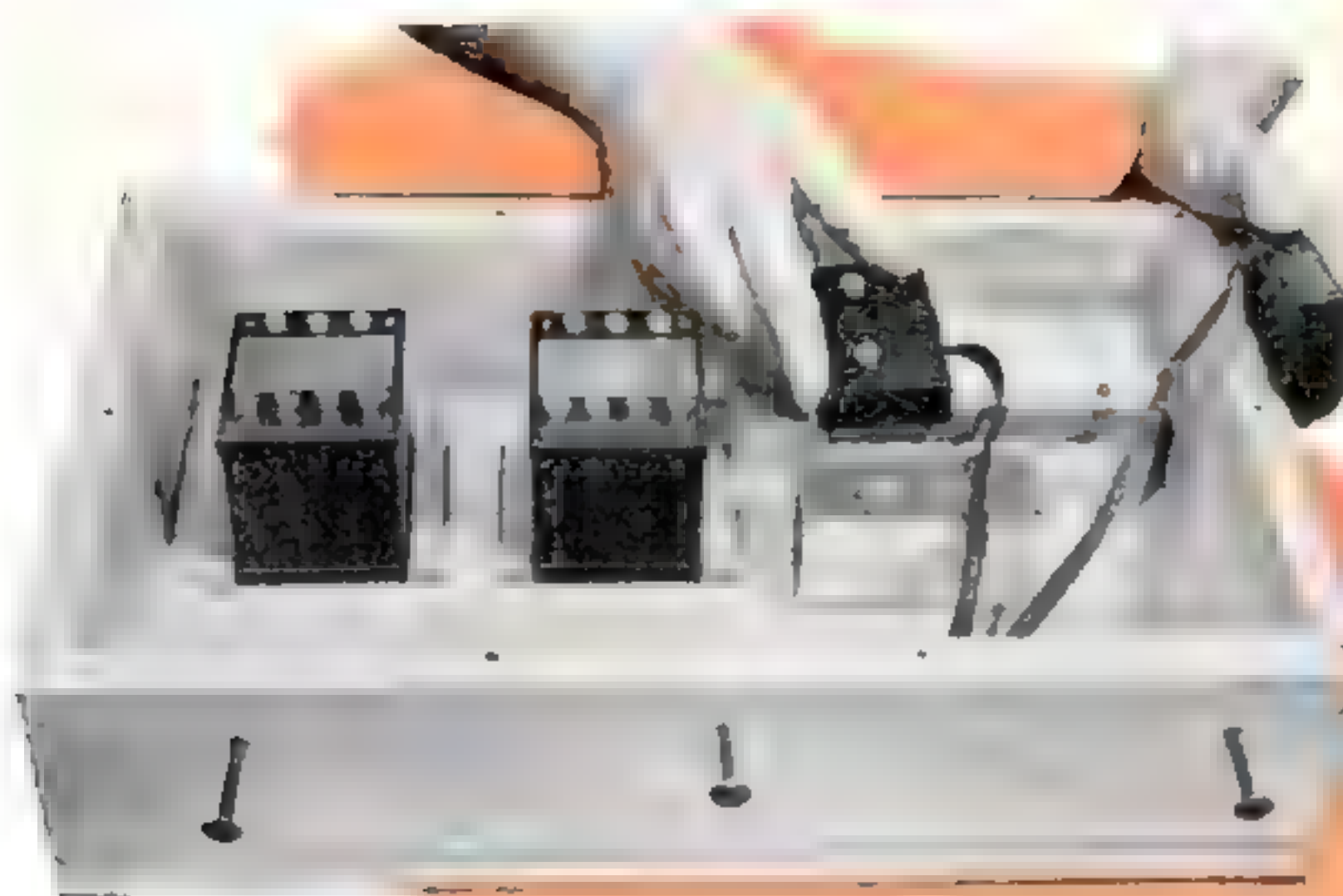
Cut the 12" by 18" panel from pressed composition wood of tempered quality or similar board, and construct a box from 13/16" stock to fit flush with the edges of the panel and 3 1/2" deep inside. The diagram provides space for mounting two whistle controllers, two rheostats, push buttons for four track switches and for four sidings, two controls for special unloading and uncoupling track, and one control for a coal elevator. Before boring the holes in the panel, check the equipment you will use with the spacing shown.

When the holes have been made in the panel, give it a coat of flat black enamel, let it dry, and mount the controls. The standard type train rheostat is used by mounting it on the underside of the panel and replacing the

sliding contact with a contact arm as sketched. Solder a wire to the contact arm and run it to the grounded binding post (the post which is not insulated from the base) on the rheostat. As you view the rheostat from under the panel, connect the left end of the resistance wire to the other post so the train will run slowest when the knob is turned to the left.

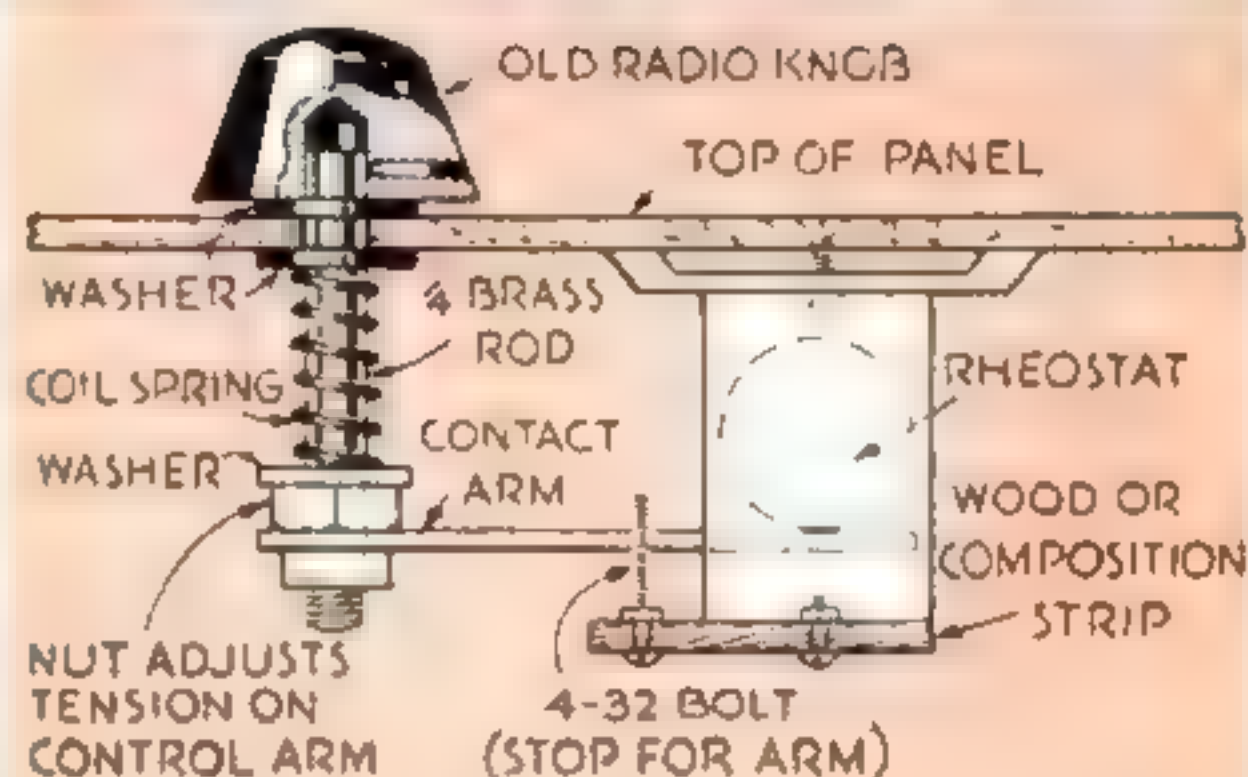


Push the adapters through from beneath the panel and use a rubber band to retain them temporarily

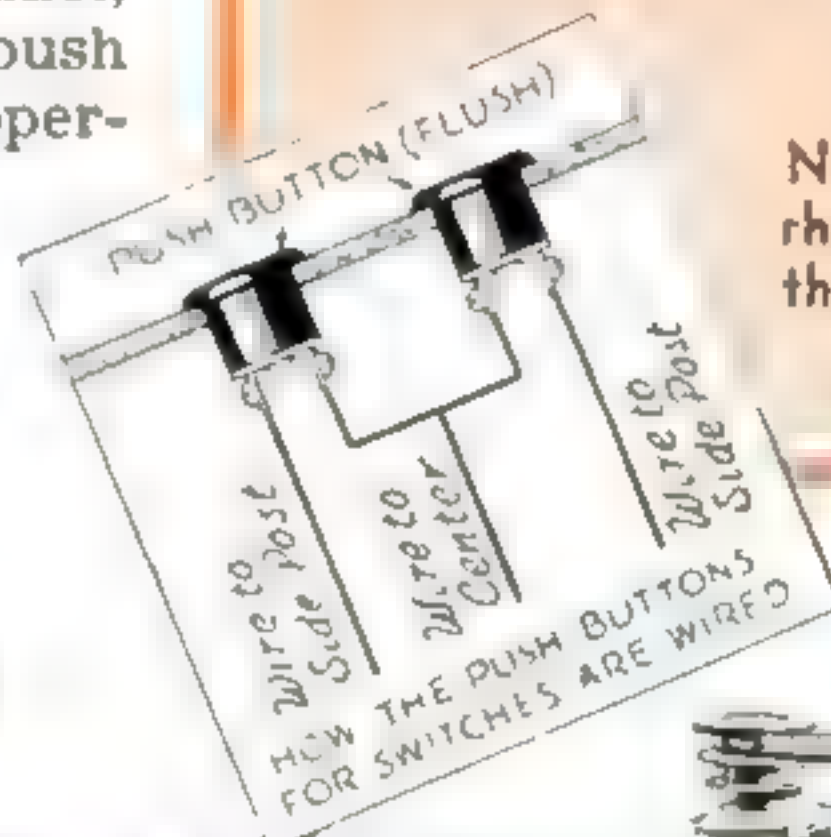


Blocking up the controls. The screws in the blocks fit slots in the bases of the controls

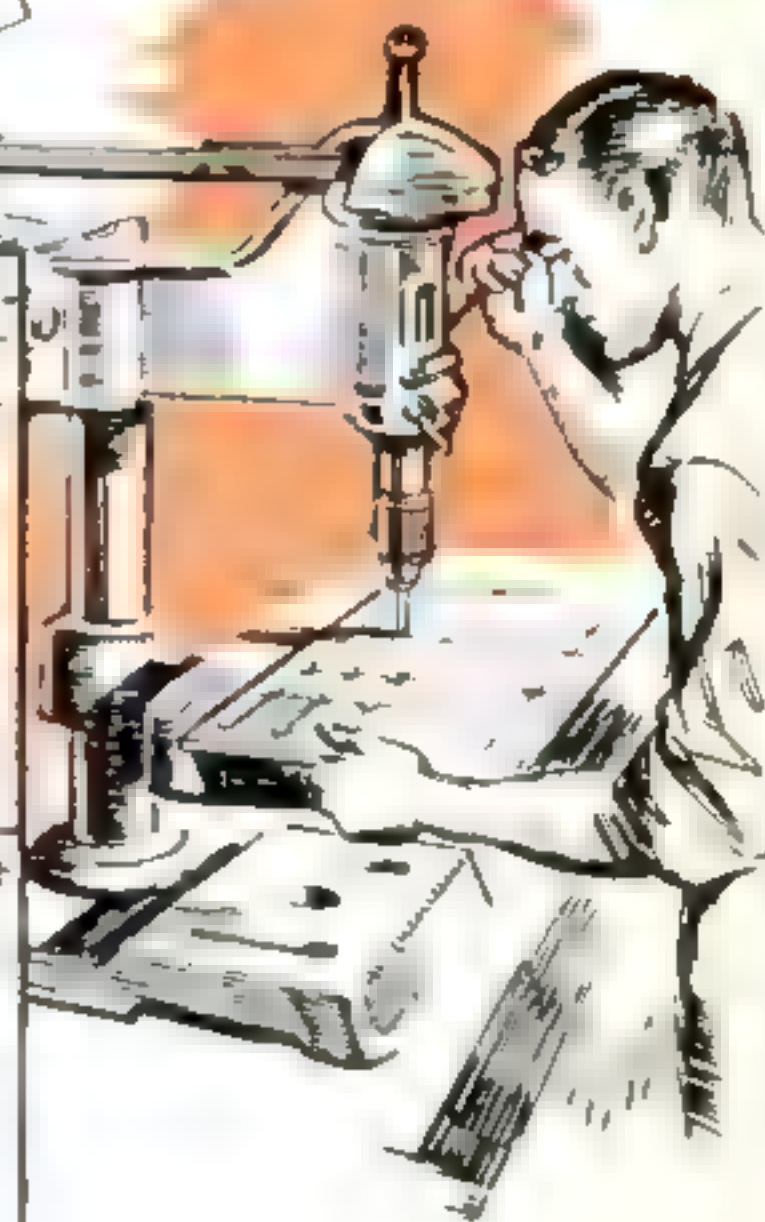
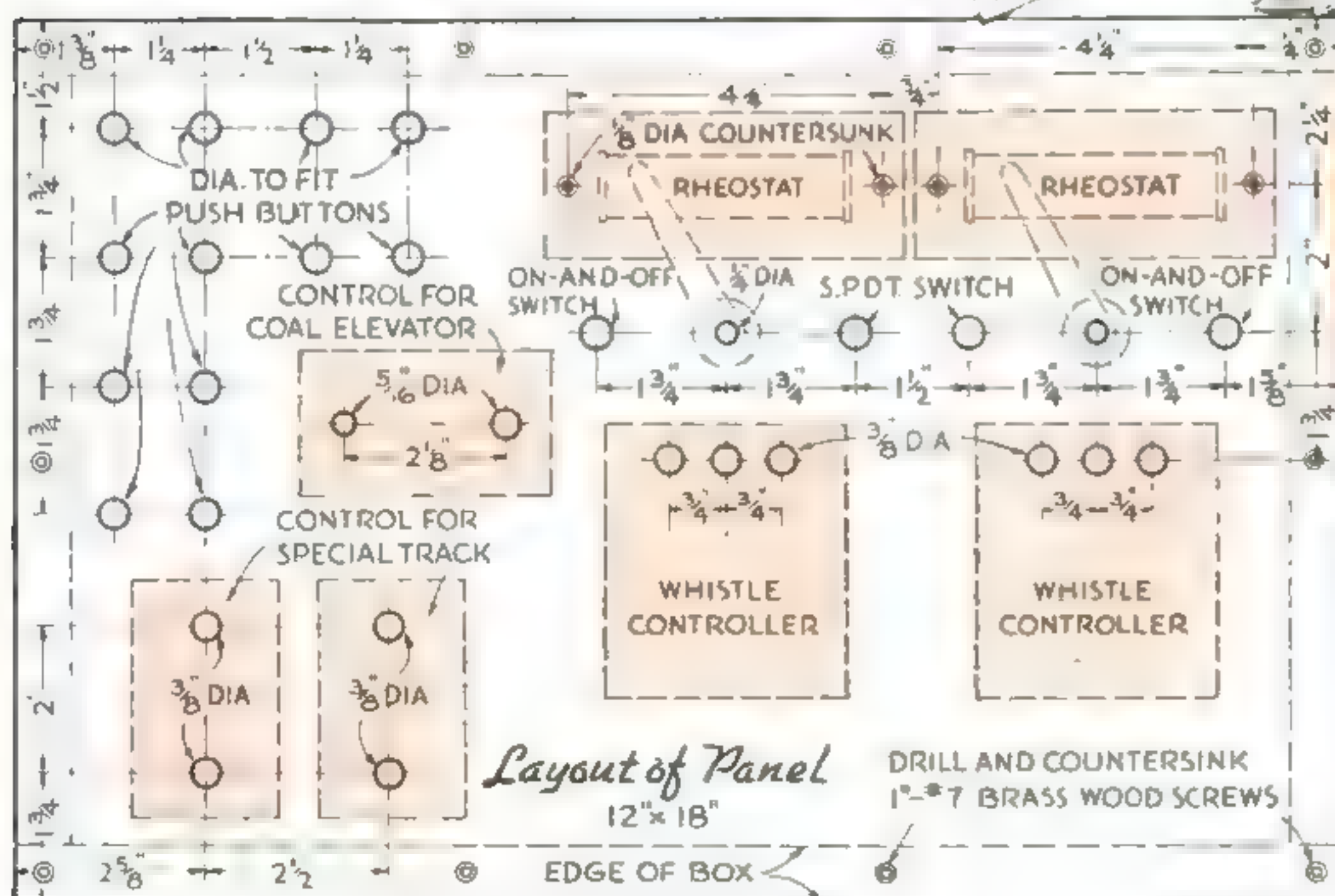
Wood adapters are turned on a lathe and project through holes in the panel to let you operate the built-in buttons on the various controls from the top of the panel. The control units are placed in the box, with their buttons centered under the proper holes, and adjusted for height with blocks of wood and pieces of cardboard so the flange on the adapters have about $\frac{1}{32}$ " clearance below the panel. Use a sleeve coupling on the coal elevator to extend the rod above the panel, and the knob supplied can be used. The push buttons replace the levers supplied to operate the switches. The off-and-on toggle switches control the current to the transformers, and the single-pole, double-throw switches step up the voltage when more than one train is operated.



New contact arm for train rheostat and, above, how the wire is soldered to it



By C. ELMER BLACK



At left, complete panel layout. The flush push buttons are wired as in the small diagram above

Flexible Rule Saves Time on Circular-Saw Work

IN USING a circular saw, it is desirable to have a rule instantly available. A good way to insure this is to fasten a flexible metal rule to the miter gauge of the saw. It is held with a clip soldered to the case of the rule.—H. R. H.



Lifting Magnet Wound on a Transformer Core



The magnet easily supports a 25-lb. anvil when energized by three cells. Right, how parts are assembled

A POWERFUL electromagnet for lifting demonstrations is easily made by utilizing the core of an audio transformer from a discarded radio set. The transformer should be the kind that has laminations shaped like the letters E and I. Take it apart and separate the laminations. A new winding is made of a size to fill the window space in the E-shaped laminations. A wooden form is required for winding the coil, and No. 18 or 20 magnet wire should be used. The coil should be taped as shown, and flexible leads soldered to the ends of the wire. The only other parts needed are eight sheet-metal yoke pieces, two hooks, and machine screws.—R. W. WAGNER.



CLEANING PAINTBRUSHES

[PAINTING]

1. Suspend brush in varnish remover deep enough to cover half the metal or leather ferrule. The brush should not rest on the bristle tips. Cover can with paper cone to prevent evaporation and leave until thoroughly softened.
2. Remove brush from can, lay on paper, and use the back of a table knife or a steel scratch brush to remove softened paint. Then brush back and forth over a small frame covered with $\frac{1}{4}$ " mesh wire cloth. Resoak in varnish remover if necessary.
3. Wipe with rags. Work a mixture of half alcohol and half turpentine into the bristles until clean. Inspect butts of bristles to be sure no hard paint remains.
4. Wash bristles in warm water and soap, and rinse in clean water.
5. Hang up until almost dry, then wrap bristles in heavy wrapping paper folded squarely so that the brush remains correctly shaped. Fasten rubber band around ferrule and keep this way until needed.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Dummies Carved by Guild Member

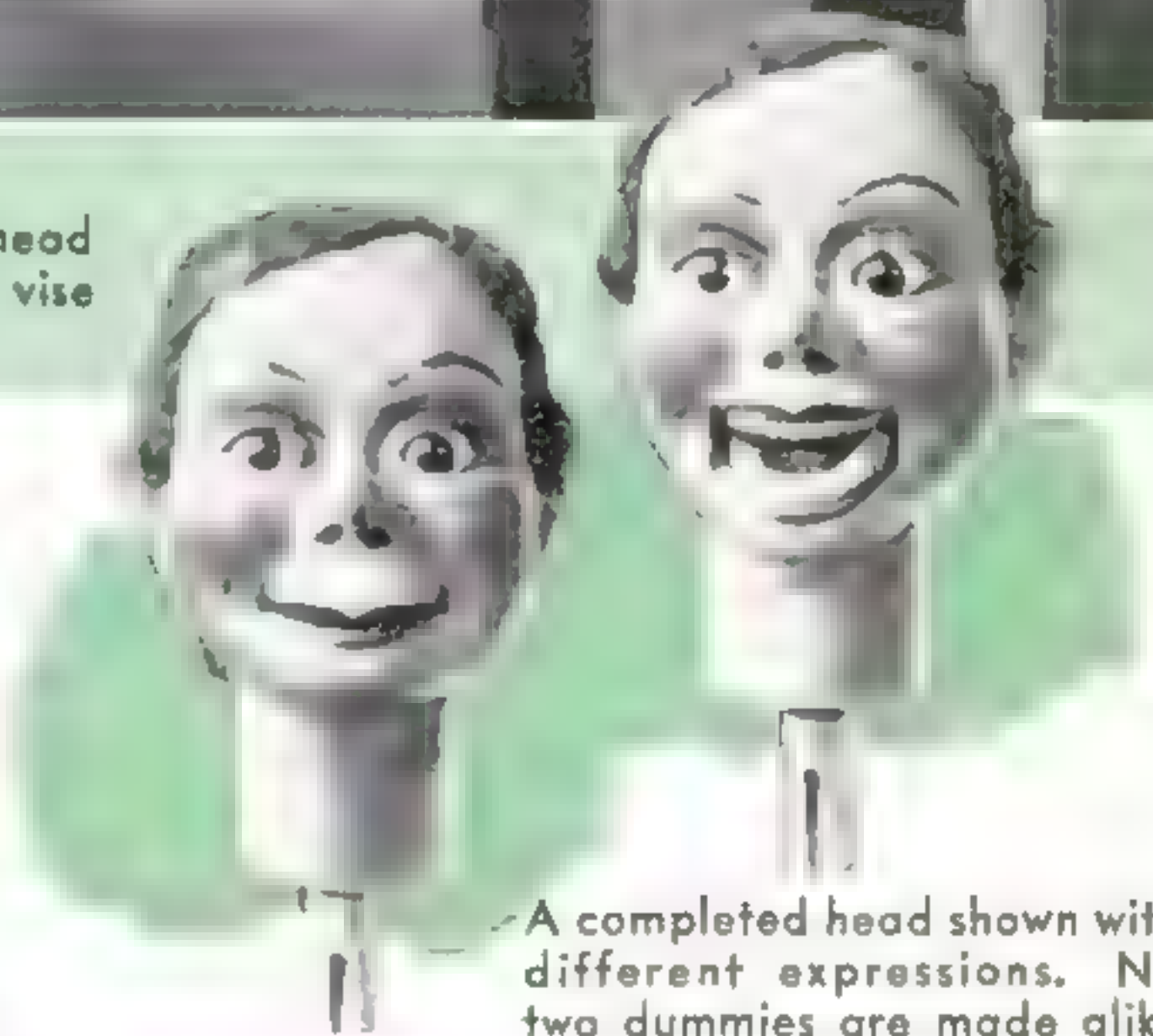
TRAVEL TO MANY
FOREIGN LANDS



George "Pinxy" Larsen, of Chicago, shaping the head for a ventriloquist dummy. Note the special vise

IN A SMALL workshop on the north side of Chicago, George Larsen, a member of the Chicago Carvers and Craftsmen's Club, carves heads for ventriloquist dummies that amuse thousands of people throughout the world. Photographs and letters from foreign ventriloquists give an indication of how far his dummies have traveled.

His friends and business associates call him Pinxy because that was his stage name when he and his wife toured America as ventriloquists, Punch-and-Judy operators, and magicians. In those days they always made their own figures, and their carvings attracted such favorable attention from fellow performers that in 1914 Professor and Madam Pinxy decided to devote the greater part of their time to the manufacture rather than the operation of such figures. But both have kept active in their old profession. Pinxy was the first person to give a Punch-and-Judy show on the radio, and his wife, in 1931, produced similar shows for a



A completed head shown with different expressions. No two dummies are made alike

series of experimental television broadcasts.

Pinxy claims the distinction of being one of the two professional carvers of "block-heads" in America. Each head is made by building up several layers of basswood blocks so that after the head is carved it can be split easily to hollow out the inside.

A sheet of paper is glued between the sections to be split. The only machine operation is the rough sawing of a face contour; all the other work is done by hand manipulation of ordinary carving tools without the use of



Members of the club in Long Beach, Calif., packing up toys for local children

Below, demonstration of fluorescent lights before the Richmond, Va., guild



Before starting its fall season, the *Fall River (Mass.)* Homecraft Club sponsored "The Southern New England Hobbyist Outing" at Touissette, Mass., which the members hope to make an annual event. Members of the Timbercraft Homeworkshop Club of New Bedford attended, and more clubs are expected next year. Prizes were awarded to the winners of various contests. Pictures were taken

by George Legault and Clifford F. Schlemmer and shown at a subsequent meeting.

Very ingenious ideas and excellent craftsmanship were displayed by the school children who entered the bird-house contest sponsored by the Kerrisdale Homeworkshop Club, *Vancouver, B. C., Canada*. "Considerable interest was aroused and it is felt that our next effort will receive far more attention," Secretary K. B. Finn reports.

A. Campbell, woodworking instructor for the local schools, demonstrated wood turning at one meeting of the club.

New officers of the Royal Homeworkshop Club, *Montreal, P. Q., Canada*, are F. Simpson, president; E. Derocher, vice president; L. Derocher, secretary; G. F. Clark, treasurer. Talks have been given on electric welding by F. Simpson, photography by R. Simpson, and carpentry by E. Derocher.

All the members of the *Beaver (Okla.)* Hobby Helpers Club are women except one youth of seventeen. Toys and lawn ornaments have been made during the past few months.

The Bison Builders Guild, *Buffalo, N. Y.*, has discontinued its HO-gauge model rail-

calipers or measuring devices. The heads are made to order and any expression the performer desires is given to the face. No two heads are alike.

Few members of clubs affiliated with the National Homeworkshop Guild, however, use their workshops as a means of livelihood. To the great majority, their shops afford a pleasant way of enjoying a hobby.

Harold Perkins and Edward Nelson of the Berkeley Homeworkshop Guild, *Bloomfield, N. J.*, have just completed a 33' motor boat. Valdemar A. Honce, secretary, is working on a Cape Cod doll house. J. P. Leonard has made a model airplane. Wilbur Stevens recently won several medals with his racing motor boats.

Samuel Kleisdorf has been placed in charge of the Christmas toy project of the *Vicksburg (Miss.)* Homeworkshop Club. A moving picture, "The Story of Gasoline," was recently shown to the members.

way layout in favor of O gauge. The base of the layout is 8' by 20', and the equipment consists of five engines and thirty cars. Ray Baer laid all the track. Earl W. Sanderson has just completed a trestle bridge. A drill press has been added to the club's equipment. New officers are Raymond Baer, president; Melvin Baer, vice president; Earl Sanderson, secretary; Clarence Zangel, treasurer.

A set of wood-carving tools and a new lathe have just been purchased for the club workshop of the *East Boston (Mass.)* Homeworkshop Club. Projects recently completed by members include a Governor Winthrop desk, twin maple beds, and a set of wood-block cuts.

When the *Denver (Colo.)* Homeworkshop Club resumed meetings in the fall, a demonstration was given on jigs and short-cut methods for making toys. The members expect to give several hundred toys to local poor children. The meeting was held in the workshop of William B. Marquis, president.

Officers of the recently organized *Hammond (Ind.)* Homeworkshop Club are Darrel J. Gapinski, president; Edward J. Lindstrom, vice president; Maurycy

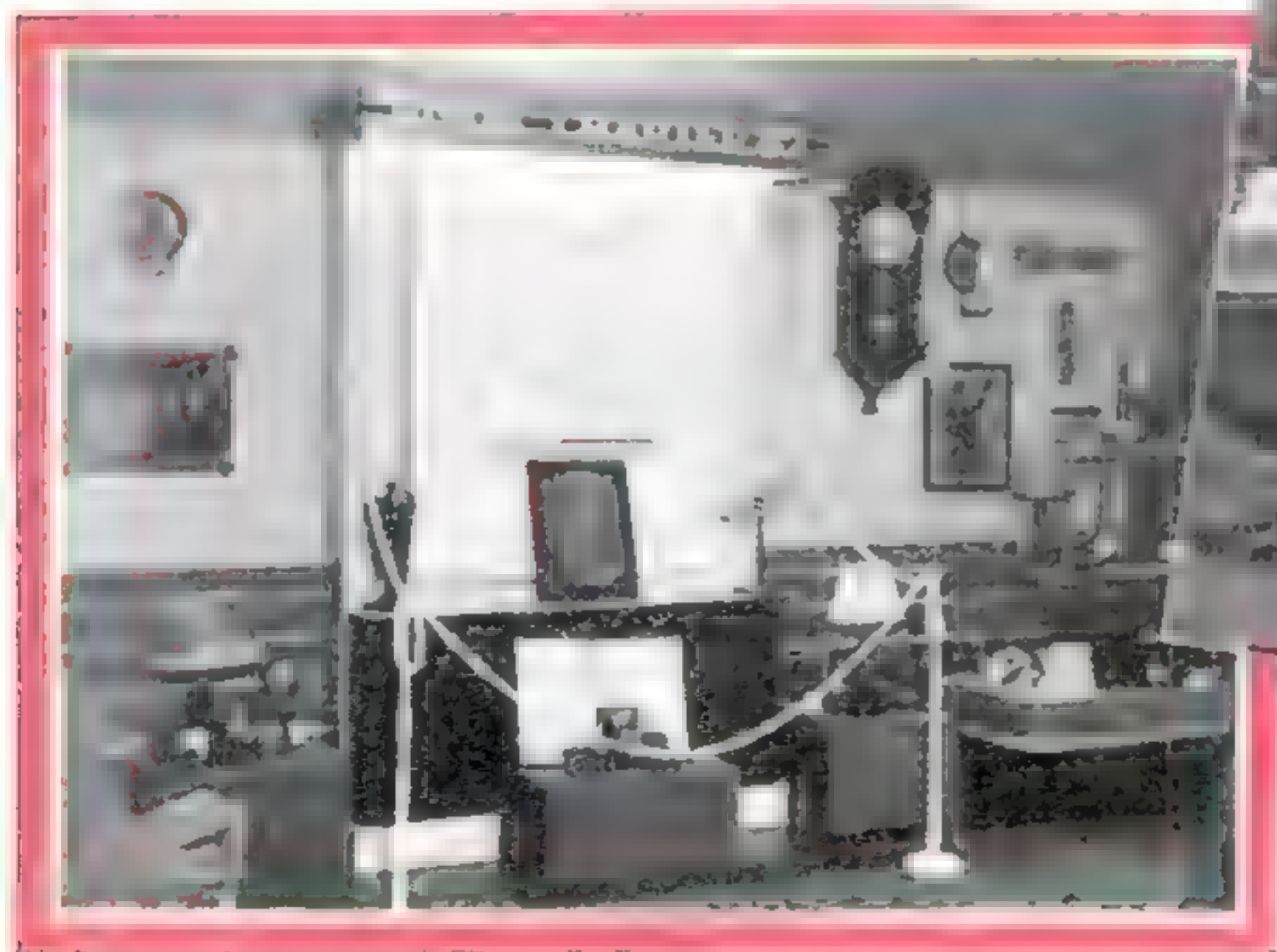
V. Gapinski, secretary; George A. Lindstrom, treasurer.

More than 500 toys have already been built by the *Columbus (Ohio)* Homecraft Club, which hopes to increase that number considerably before Christmas. Toys for very small children are stained with water-soluble vegetable dyes because paints might contain poisonous metallic compounds.

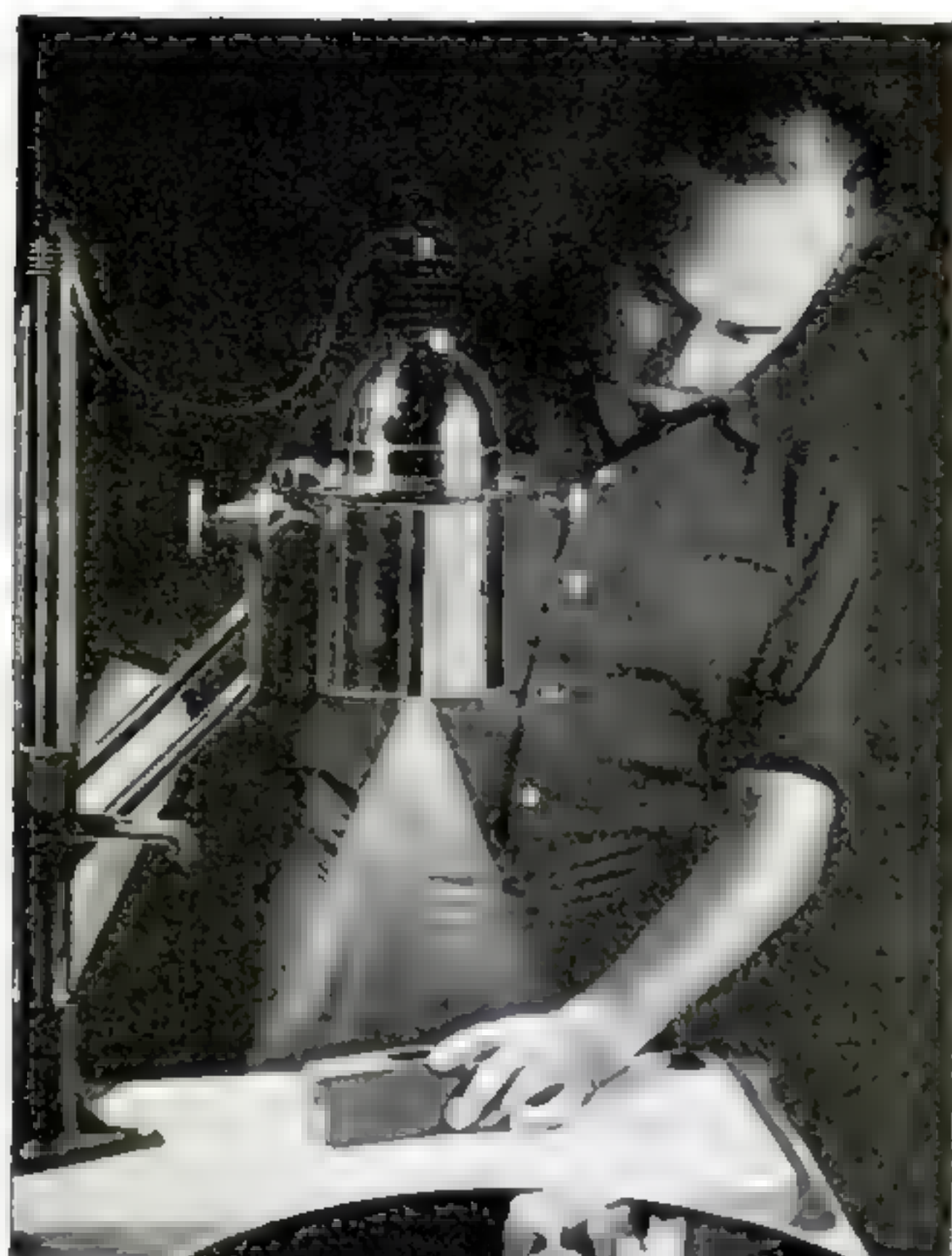
Other clubs reporting progress with their toy projects include the *Whitby (Ont., Canada)* Craftsmen's Guild, *Springfield (Ohio)* Homeworkshop Club, and *Danville (Ill.)* Homeworkshop Club. The latter club is awarding a prize for the most outstanding toy made by a member.



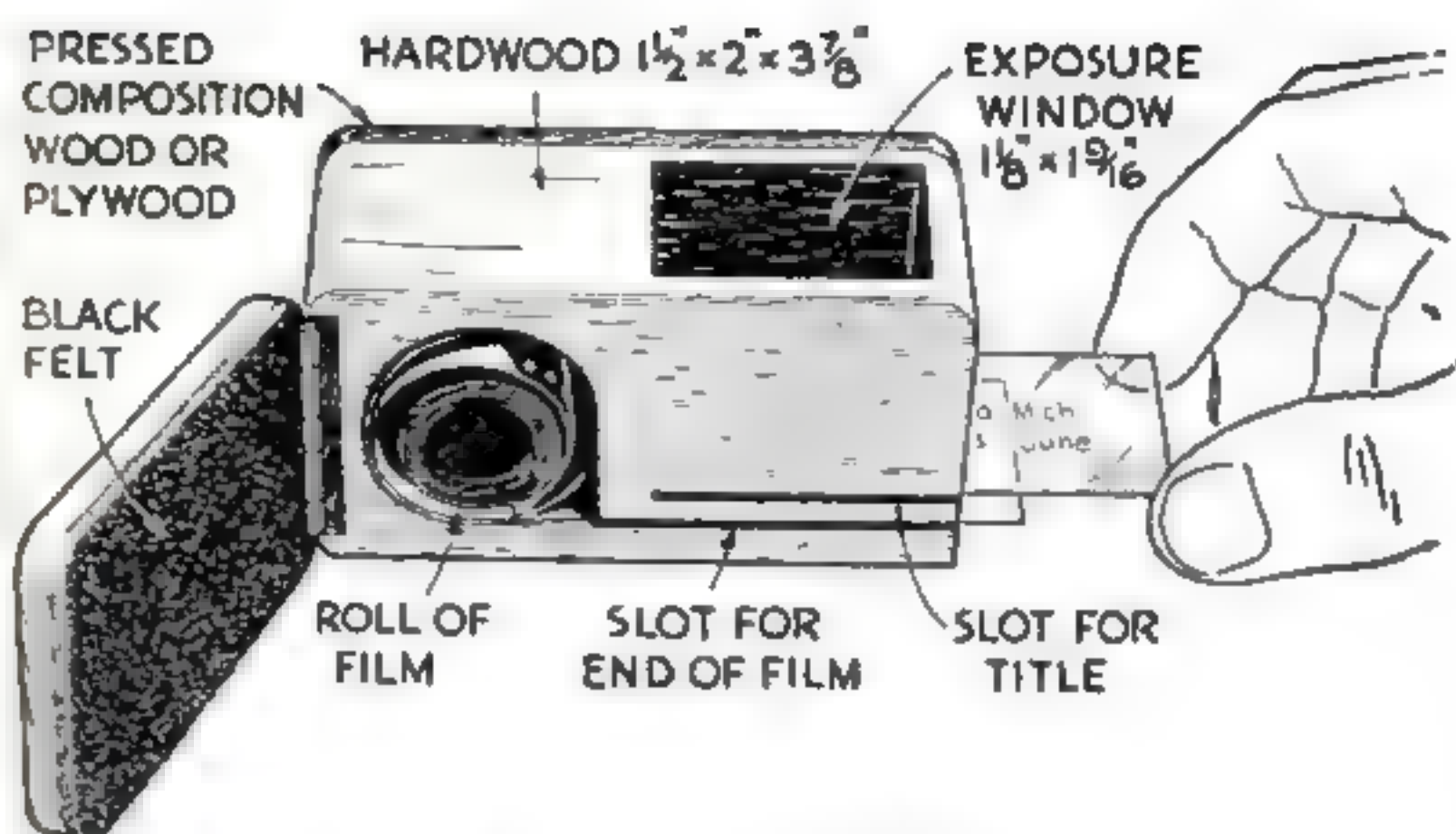
Part of the exhibit of the Bison Homeworkshop Guild, Buffalo, N.Y. Right, Herman W. Lorenz, secretary



Left, focal point of the show, which is held annually in the club's quarters above a garage



Sawing the two slots and film opening in a block. At top, the enlarger light is flicked on and off



Picture Data Recorded Directly on Film

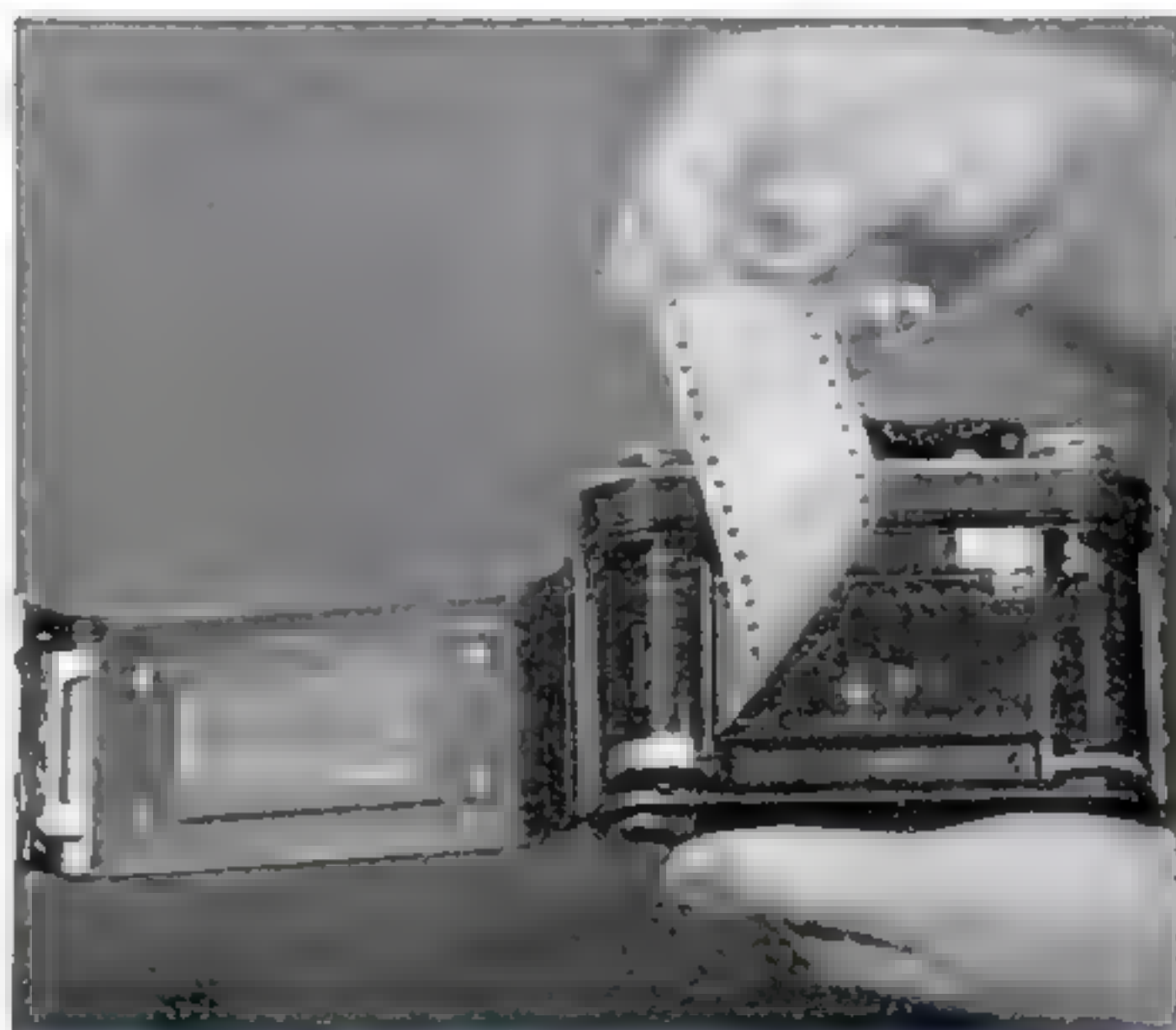
CONTAINERS in which spools of 35-mm. film are packed have convenient spaces for the writing of information and data, but that gives no assurance that a roll of negatives will always be returned to the correct box. When it is not, whatever method of filing is used will be seriously upset. It is far better, therefore, to print the data permanently on one of the several frames of unexposed film at the end of each roll. This can be done with the aid of a "datagraph" made as shown and painted inside with matte-black varnish or shellac mixed with lampblack.

The roll of film can easily be slipped into its compartment in the dark, and the end drawn forward until it is under the exposure window. A celluloid slide, with the data typewritten on it or written in India ink, is placed in the upper slot beforehand, so you can be sure that it is centered. The exposure is then made by placing the datagraph on the easel of your enlarger and flicking the light on and off.—KENNETH MURRAY.

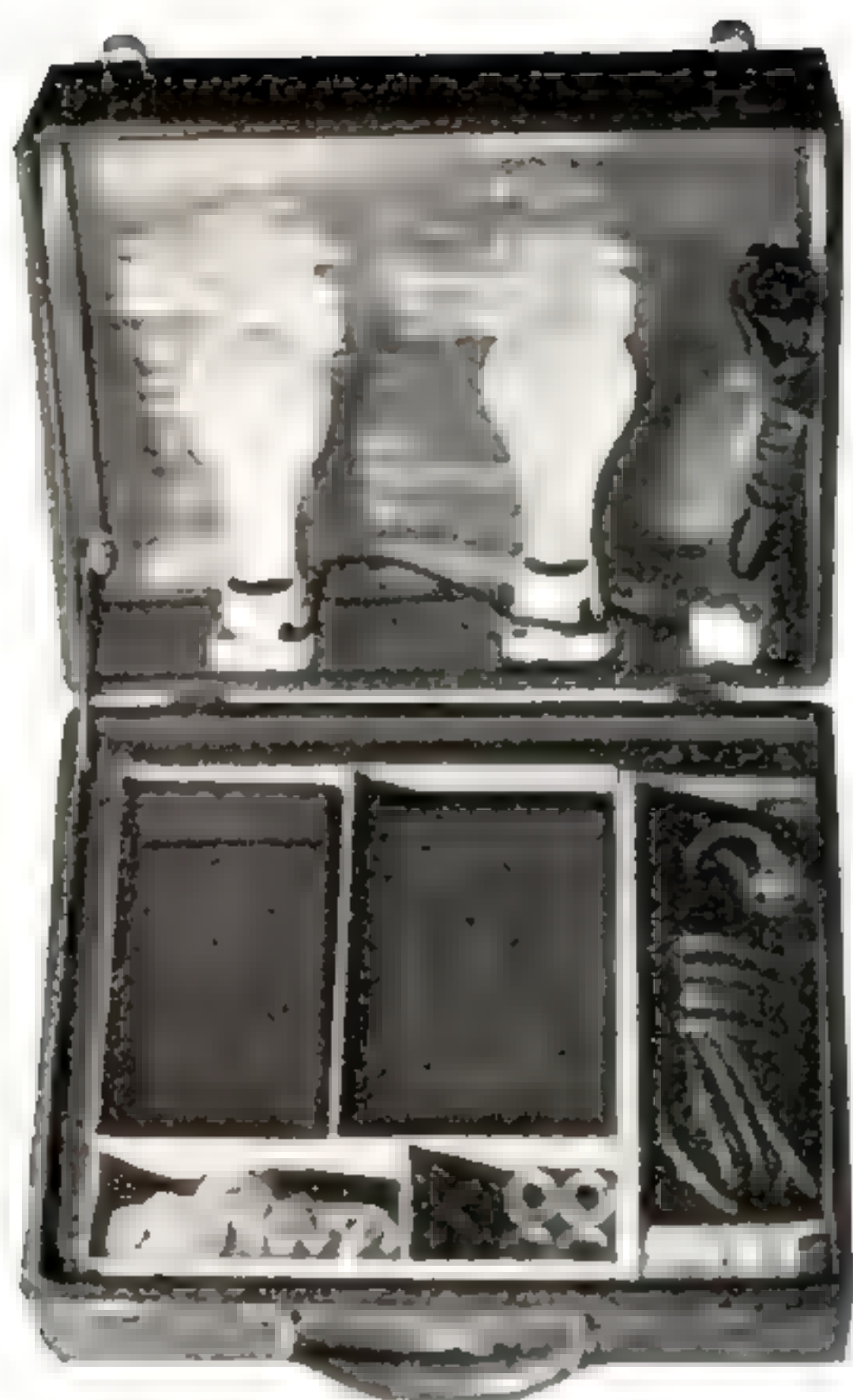
Miniature Transparencies Printed in Camera

AMATEURS who wish to make positive transparencies from their 35-mm. negatives can do so by using their cameras as printers. To do this, place the negative and a length of 35-mm. positive film together, emulsion to emulsion. Then, with the negative facing in, wind the films into a daylight cartridge. Load the cartridge into the camera so that both films wind onto the take-up spool, and be sure that the automatic winding key is locked when a negative is perfectly framed in the film plane behind the lens. When the camera is closed, the winding key will then automatically space the negatives and positives correctly.

Exposure is made by placing the lens about 1" from a 100-watt bulb and snapping the shutter. The length of exposure can be determined by making some preliminary tests before doing the complete film.



To make positive transparencies, the negative and positive films are placed together in the camera



Left, the completed case. A slotted bracket with a wing nut enables the lighting unit to be fastened at any angle as above

Lighting Unit Built into Camera Accessory Case

BESIDES holding a camera and all its accessories, this carrying case serves as a portable lighting unit. The original was made from a portable phonograph case obtained from a junk dealer, but any small sample case or suit case may be used if it has a cover as deep as the case itself and at least 3½" deep.

The cover serves as the lighting unit and is lined with tin. Two lamp sockets and an outlet are screwed to the hinge side of the cover, and the coil of wire is attached to the

end with a hook and eye as shown. To hold the cover at the desired angle, a bolt and wing nut are used in conjunction with the slotted lid support.

A ledge of ½" strips of wood is fastened around the inside of the main compartment of the case so that a rectangular panel of wood can be cut to rest on it and thus separate the contents from the lighting unit. The case is then divided into compartments to suit individual requirements and lined with felt or velvet.—LOUIS HOCHMAN.



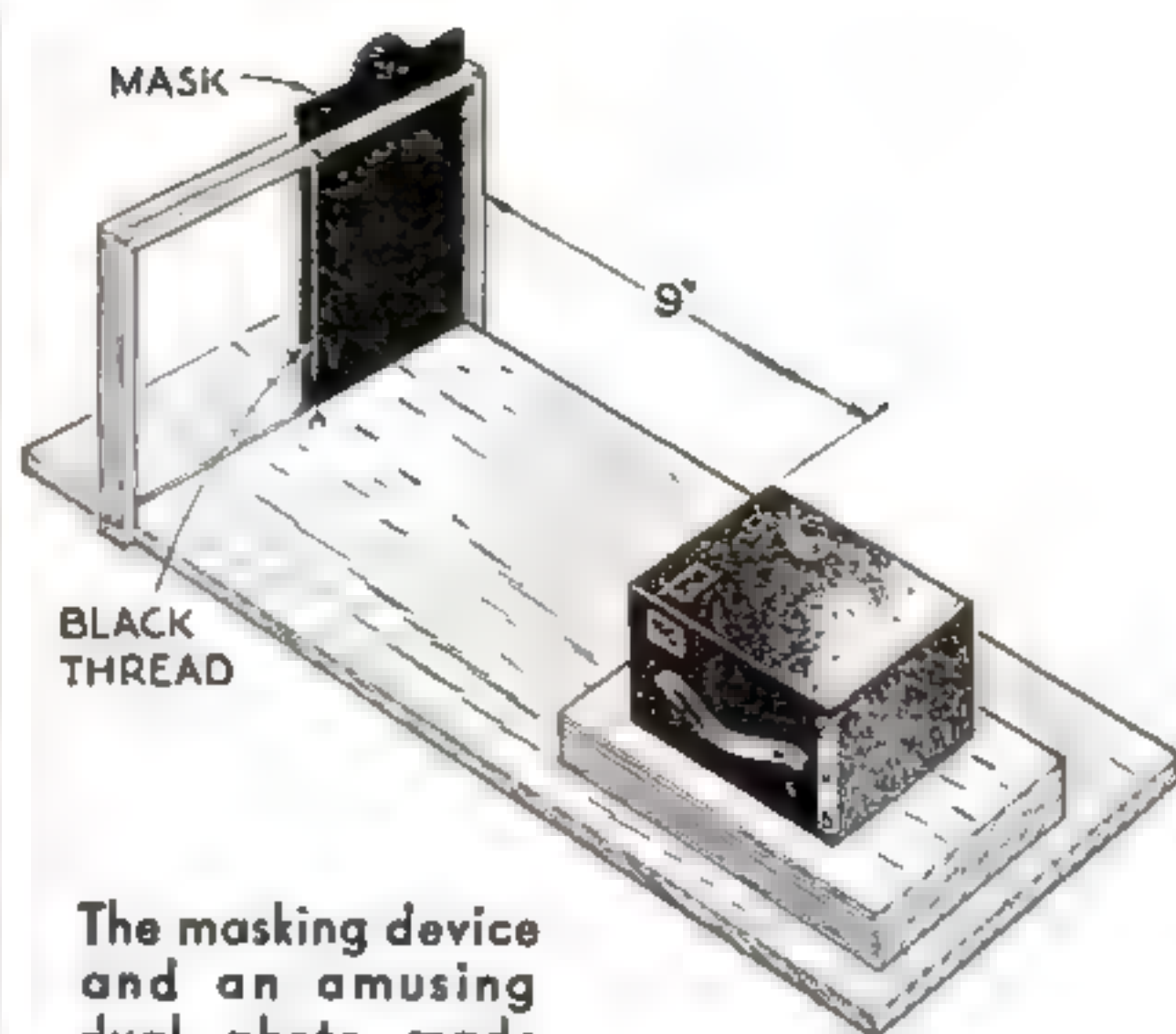
Simple table-top arrangements can be photographed and used as novel greeting cards for the holidays

Alphabet-Soup Letters Spell Out Greeting

NOVEL photographic greeting cards may be made by using table-top set-ups like the one illustrated. The message is spelled out in letters taken from a package of alphabet-soup noodles and glued on black paper. These clearly formed little letters are also useful in composing short titles for home movies.—J. J. MIHOK.

Line Drawing Made from Print

TO CONVERT a photograph into a line drawing, trace the portions desired with waterproof India ink. Then bleach out the print in the following bath: 62 grains potassium bichromate, 90 minims sulphuric acid, and 16 ounces water. Wash the paper thoroughly.



The masking device and an amusing dual photo made by Lewis Shrauder

Foolproof Set-Up for Trick Double Exposures

DUAL photographs can be successfully taken by setting up a framework in front of a camera as shown in the accompanying drawing. The upper crosspiece of the framework is slotted, and the baseboard is grooved so that a mask can slide from one side to the other. The mask itself is a piece of cardboard half the width of the frame, but slightly higher. It must be painted flat black. Note that a black thread is secured to the frame to mark the vertical center line.

The camera is firmly mounted in such a position that the lens will be 9" from the frame and directly in line with the thread. The mask is placed so that one edge coincides with the thread. An exposure of the subject to be "doubled" is then made through the open side of the frame. Care must be

taken to shield the mask from all direct light. The mask is now moved to the opposite side with its other edge even with the thread, and the subject is posed in the other half of the picture. An exposure of exactly the same duration is made. Care must be taken, of course, that the apparatus is not moved or jarred during or between the two exposures.—GUY HUNTINGTON.

Causes of Milky Fixing Bath

WHEN a hypo fixing bath has a milky appearance, it may be due either to an excess of free acid, which decomposes the hypo and precipitates free sulphur, or to insufficient acid. Other causes are insufficient or impure sulphite or careless mixing.

DAYLIGHT EXPOSURE TABLE

[PHOTOGRAPHY]

Subject	Brilliant			Bright			Average			Shaded		
	100	50	24	100	50	24	100	50	24	100	50	24
Weston Daylight Emulsion Rating												
Bright Sun	f/22	f/16	f/11	f/16	f/11	f/8	f/11	f/8	f/5.6	f/8	f/5.6	f/4
Hazy Sun	f/16	f/11	f/8	f/11	f/8	f/5.6	f/8	f/5.6	f/4	f/5.6	f/4	f/2.8
Cloudy-Bright	f/11	f/8	f/5.6	f/8	f/5.6	f/4	f/5.6	f/4	f/2.8	f/4	f/2.8	f/2
Cloudy-Dull	f/8	f/5.6	f/4	f/5.6	f/4	f/2.8	f/4	f/2.8	f/2	f/2.8	f/2	.....

Brilliant Subjects—Distant landscapes and mountains without prominent dark objects in foreground; beach, marine, and snow scenes.

Bright Subjects—Scenics with objects in foreground; nearby people in beach, marine, and snow scenes.

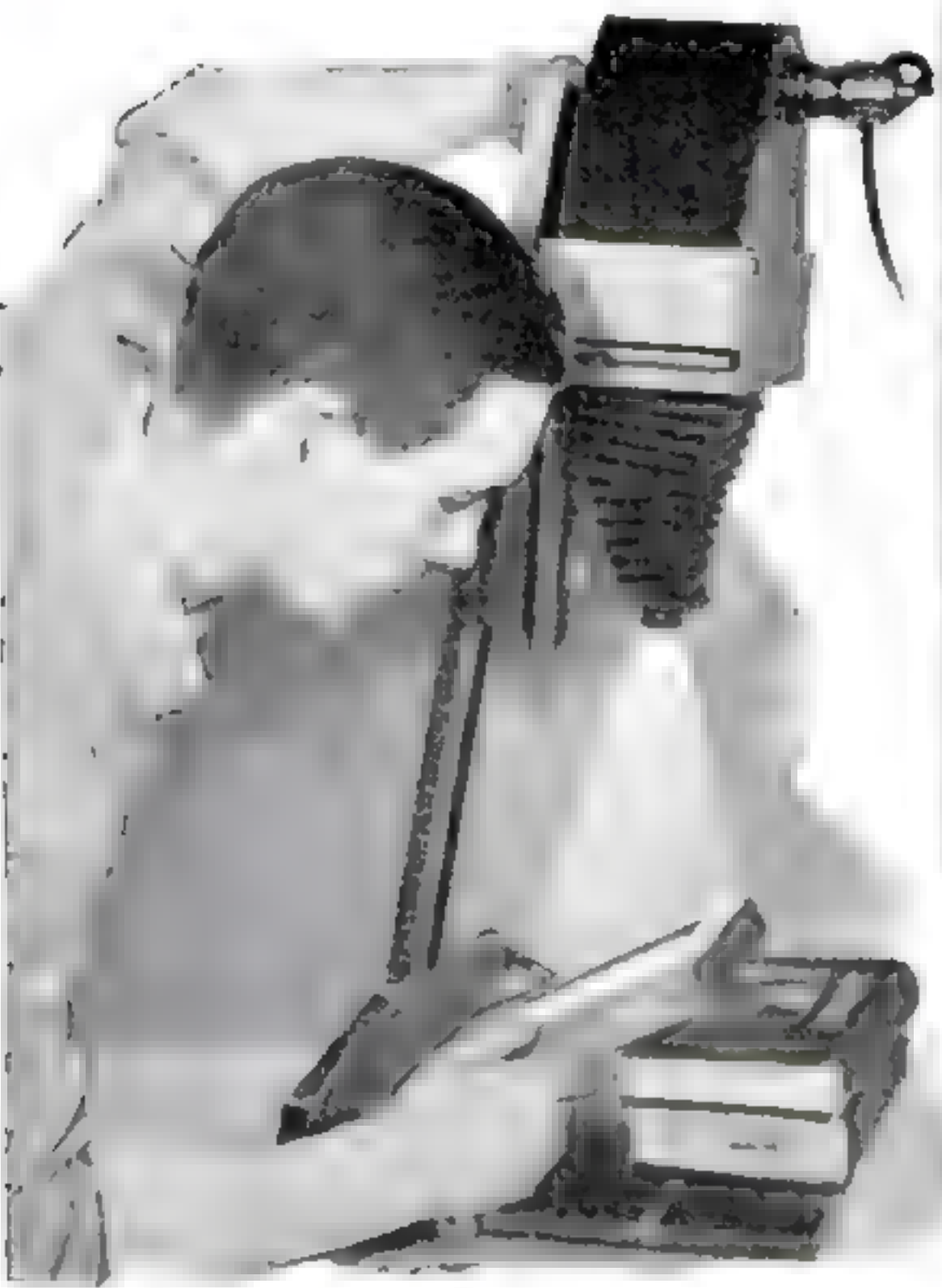
Average Subjects—Nearby people, gardens, houses, and scenes not in shade. (Use this classification if in doubt.)

Shaded Subjects—People, gardens, and other objects in open shade. They must be lighted by open sky, not under trees, porches, roofs, etc.

NOTE: Each of the following diaphragm stops is approximately twice as large as the preceding one: f/22, f/16, f/11, f/8, f/5.6, f/4, f/2.8, f/2 (largest). The figures above are lens apertures at 1/100 sec. Therefore, for 1/50 sec. use opening only half as large; for 1/25 sec., one-quarter as large; for 1/200 sec., twice as large. Example—f/11 at 1/100 sec. is equal to f/16 at 1/50; f/22 at 1/25 sec.; f/8 at 1/200 sec.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

In the left-hand picture of the pair at the right, the building seems to be leaning backward. This was corrected in the second view simply by tilting the enlarging paper as shown below



Skillful Enlarging Corrects Distorted Building Photos

WHEN a camera is tilted upward at a tall building, the resulting picture appears to taper and the building looks as if it were leaning backward. Professional view cameras, to be sure, have a revolving back or lens mount that permits this distortion to be corrected, but the defect is common to all ordinary cameras such as amateurs use. It may be overcome, however, by projection

printing with the easel or paper holder tilted sufficiently to straighten the image.

A short-focus projection lens may be necessary if the distortion is very great. The sample pictures, for example, were projected with a 4" lens. Focus the image at the center of the paper, then close the iris of the enlarger until the image is sharp to the edges. This is necessary to get sufficient depth of focus to cover the paper in the tilted position.—C. W. RICKMAN.

INDOOR EXPOSURE GUIDE

[PHOTOGRAPHY]

Number and Type of Photofoods	Weston Tungsten Emulsion Rating	Distance (in feet) from Lamps to Subject							
		3½	5	6	7	8	10	12	14
2 No. 1	64	f/11	11-8	8	8-6.3	5.6	4.5	4	3.5-2.8
	32	f/8	8-6.3	5.6	4.5	4	3.5-2.8	2.8	2.2
	16	f/5.6	4.5	4	3.5-2.8	2.8	2.2	2	.....
1 No. 1 and 1 No. 2	64	f/16-11	11	11-8	8	8-6.3	5.6	4.5	4
	32	f/11-8	8	8-6.3	5.6	4.5	4	3.5-2.8	2.8
	16	f/8-6.3	5.6	4.5	4	3.5-2.8	2.8	2.2	2
2 No. 2	64	f/16	16-11	11	11-8	8	8-6.3	5.6	4.5
	32	f/11	11-8	8	8-6.3	5.6	4.5	4	3.5-2.8
	16	f/8	8-6.3	5.6	4.5	4	3.5-2.8	2.8	2.2

NOTE: Each of the following diaphragm stops is approximately twice as large as the preceding one: f/22, f/16, f/11, f/8, f/5.6, f/4, f/2.8, f/2 (largest). The figures above are lens apertures at 1/25 sec. Therefore, for 1/50 sec., use opening twice as large. Lamps must be in good reflectors.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

NOVEL SPATTER-PAINTED XMAS CARDS



IF YOU want something novel yet inexpensive in the way of Christmas cards this year, try spatter-painting them yourself with an old toothbrush. The more you spatter on the color, the prettier they will be. The effects are somewhat like linoleum-block work except that the colors are not solid, but broken up into interesting and variegated spatter patterns.

This method is basically the same as stenciling, therefore it is much easier and quicker than block printing. Simply follow these step-by-step directions:

1. Make a full-size drawing on paper with any de-

Left, several suggestions for simple cards. A good alphabet for stencil cutting is given in the strip below

A B C D E F G H I J K L M



The first step is to make a full-size drawing on paper and ink in the parts to be cut away



The stencil is then prepared by carefully cutting out the openings with a very sharp knife

**The design and lettering
are cut like a stencil,
and the color is applied
by means of a toothbrush**

• • •

sired design and lettering. Fill in with ink or pencil the portions that are to be cut out.

2. Break a double-edge safety-razor blade so that it has a sharp point or use a stencil knife and carefully cut out the blacked portions to form a stencil.

3. Put the stencil in position over the card stock. Fasten it with thumb tacks at the edges.

4. Dip the toothbrush in thin poster paint or colored ink and flick the bristles with a finger so as to spatter the color through the stencil. The spattering can be done by using a stick in place of a finger, if preferred. Let the color dry before removing card.

Keep your designs simple for maximum effectiveness. It's often what you leave out rather than what you put in that's important. Geometric designs are best for the beginner because they can be drawn with pencil, ruler, and compass. The accompanying alphabet is especially adapted to stencil cutting.—DELMAR W. OLSON.



**SPATTERS GIVE
GAY EFFECT**

By the spattering method, the color is broken up in interesting patterns. Left, using a stick to flick the brush

W O P Q R S T U V W X Y Z



Next, the stencil is fastened over the card stock, which may be of any appropriate color



The spattering is done with an old toothbrush dipped in thinned poster paint or colored ink

Chemical Analysis

By **RAYMOND B. WAILES**

MINERAL oil had been substituted in part for butter fat," U.S. health officials reported, when they recently had 664 tubs of butter seized and condemned. While not common, such instances do occur, and Federal agencies are vigilant to detect them.

How did they know in this case that valuable butter fat had been replaced with paraffin or mineral oil, worthless as a food? As an amateur analyst, in your own home laboratory, you can make the same test

of butter that the Government chemist did.

Fold a four-inch filter paper the usual way, twice upon itself, and set it in the top of a small beaker or glass tumbler. Do not wet the paper, as you would for ordinary filtering. Place about ten grams (a heaping teaspoonful) of butter in the folded filter. Then melt the butter by setting the vessel in a warm oven, or holding it some distance above a Bunsen burner. Liquid butter fat filters through, leaving behind the salt and curd, and most of the water, which is absorbed by the dry filter paper.

The test for paraffin oil is made upon the clear butter fat that comes through the filter. Measure off one cubic centimeter (approximately a quarter teaspoonful) of this liquid fat into a large test tube, about an inch in diameter and eight inches long. Add one cubic centimeter of a one-to-one solution of potassium hydroxide. This is made by dissolving a small amount of the solid alkali in an equal weight, or twice its volume, of water.

Shake the mixture and then add twenty-five cubic centimeters, or a scant fluid ounce, of ninety-five-percent grain alcohol. (Weaker alcohol or denatured alcohol will not serve.) Now place the test tube in a beakerful of hot water. Apply enough heat to the water to maintain the contents of the test tube for fifteen minutes at a temperature of approximately eighty degrees C., or 175 degrees F., stirring the mixture frequently with the laboratory thermometer that you use to measure the temperature. At the end of the fifteen minutes, add twenty-five cubic centimeters of water and mix the contents of the tube well.

If the liquid mixture becomes turbid or milky after you add the water, then



BEILSTEIN TEST

Red-hot copper gauze glows with a bluish-green light if a substance containing one of the halogen family of elements is held in the flame beneath it

TEST FOR BORAX

Mouth washes containing sodium perborate are sometimes adulterated with plain borax. This simple test will reveal the presence of borax in a mouth wash



for Amateurs

the butter contains half of one percent or more of mineral oil.

This test is easy to make, and the chemistry of it is equally simple. The butter fat is first saponified, or turned into a soap, by the alkali (potassium hydroxide). This soap dissolves in the alcohol, and is not precipitated by the final addition of water. In contrast, any mineral oil present will not be acted upon by the alkali. It will not dissolve in the final mixture of alcohol and water, and separates out as a milky suspension, or in free oily drops.

With the aid of your home laboratory, you can easily distinguish between coffee and coffee substitutes. After a bit of practice, you can even make a rough estimate of the relative amounts of caffeine in these products and in tea.

You will need an iodine solution of what a professional chemist would call "tenth normal" strength (written "0.1 N"). For the precision that he requires, it would contain exactly 12.692 grams of iodine for every 1,000 cubic centimeters of solution. Of course it is out of the question to approach such exactitude with the rough-and-ready balance used by most amateur chemists, but you can easily make an approximately tenth-normal iodine solution that will serve your purpose.

First dissolve about ten grams of potassium iodide crystals in fifty cubic centimeters (one and two-thirds fluid ounces) of water. Then add, while stirring, two and a half grams of solid iodine crystals. (In general, solid chemicals average about five grams to the teaspoonful, though it is preferable to weigh out the amounts given when possible.) When the iodine has dissolved, dilute the resulting solution to a volume of 200 cubic centimeters (six and two

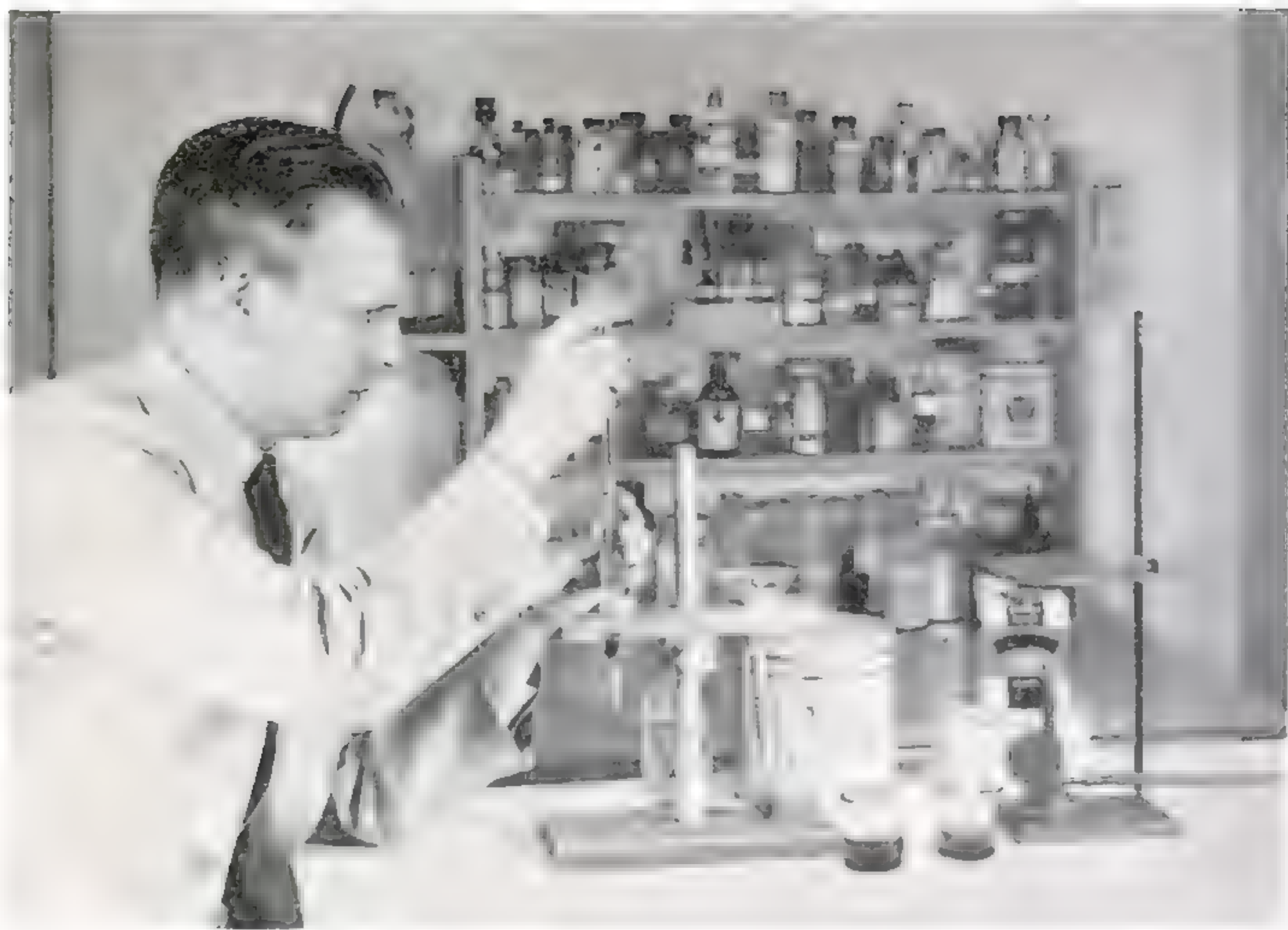
thirds fluid ounces) by adding water to it.

Also make a dilute solution of sulphuric acid, by slowly adding five cubic centimeters of strong sulphuric acid to twenty-five cubic centimeters of water, and then stirring. (CAUTION: always dilute strong sulphuric acid by adding it to the water, *not* the water to the acid. In the latter case, the considerable heat generated in mixing might turn the water to steam, and spray the powerful acid from the vessel.)

For your coffee-testing reagent, mix your dilute sulphuric acid solution with an equal volume of your tenth-normal iodine solu-



BUTTER FAT OR MINERAL OIL? You can easily duplicate the method used by pure-food inspectors to detect adulterants in butter



Measuring out iodine-acid reagent for experiment to determine the amount of caffeine in coffee or tea

tion, and you are ready for the experiment.

To compare the amount of caffeine in coffee, coffee substitutes, and tea, equal quantities of the samples should be used—for instance, five grams, or else a teaspoonful, of each. The sample of coffee or coffee substitute should be boiled, say for five minutes, in about fifty cubic centimeters of water. Tea leaves may simply be infused in hot water for the same length of time.

Filter the extracts, and dilute two cubic centimeters of each filtrate with an equal volume of water, in separate test tubes. Now add two cubic centimeters of your sulphuric acid-iodine reagent to each of the tubes. A reddish-brown precipitate will be formed, due to caffeine and certain other extracted substances that react with iodine. The more caffeine in the original sample, the more precipitate there will be.

If you have simultaneously made your test on ordinary household coffee and on a caffeine-free substitute, or coffee from which most of the caffeine has been extracted, you will observe much more precipitate in the first case. You will also observe that coffee-substitute infusions become blue-colored when tested; or, if they also contain some true coffee, take on a dirty bluish-green color.

While this simple test does not determine the percentage of caffeine in a given sam-

ple, it does give a fair indication of the *comparative* quantities of caffeine in different samples, provided it is performed in a standard way—that is, using identical quantities and treatment.

Two more household products offer an interesting experiment in analysis—sodium perborate, used as a mouth wash; and borax, or sodium tetraborate, employed in the laundry. Though they look just alike, you can readily distinguish them by a simple chemical test.

Place some borax and sodium perborate in separate test tubes, using in each case a quantity of the chemical about as large as a pea. Dissolve the materials by adding about five cubic centimeters of water to each tube. Now add, to each solution, two cubic centimeters of a copper sulphate solution of practically any strength.

In each case a precipitate, consisting of a compound of copper and boron, will be formed. The precipitate in the perborate tube will be olive green. After about a minute it will rise to the top of the solution, buoyed up by bubbles of liberated oxygen gas. The precipitate in the borax tube will be blue in color, and will remain at the bottom of the tube, since no oxygen is released.

The same test will show when perborate mouth wash has been adulterated with

borax, as might possibly be the case with a cheap, "bootleg" preparation. If the mouth wash contains less than about fifty percent of borax, the precipitate will be olive green. A blue precipitate indicates that more than half of the preparation is borax; and, when the precipitate does not rise, that borax represents eighty percent or more of its composition.

In the course of your experiments as an amateur analyst, you will enjoy trying out the simple but extremely sensitive "Beilstein test" used by professional chemists. Named after the scientist who first described it, this test detects the presence of volatile organic compounds of the halogen family of elements—iodine, bromine, chlorine, and fluorine.

Above a Bunsen flame, support a roll of copper screen or sheet copper—or better yet, if you can obtain it, a tube of Monel metal. When the screen or tube becomes hot, the substance to be tested for a halogen is inserted in the flame by means of a loop of platinum, nichrome, or iron wire. The halogen compound is volatilized and decomposed by the flame, and a beautiful bluish-green glow surrounds the copper or

Monel metal, replacing its luminous red heat. The striking color change is plainly visible even when the substance tested contains only an extremely small quantity of an organic halogen compound.

To show the sensitiveness of this test, uncork a bottle of carbon tetrachloride somewhere in the room, while the copper or Monel metal is being heated. Almost immediately the blue-green color appears, as the carbon tetrachloride vaporizes and diffuses through the air.

Many substances containing volatile organic halogens, such as chloroform liniment, produce the bluish-green color when the stopper of the bottle, alone, is held near the air hole at the burner base.

Some mechanical refrigerators employ volatile organic compounds of fluorine as the refrigerating gas. The Beilstein test will respond to such a gas, and a practical instrument has been devised to apply this test for detecting leakage from refrigerating systems.

So fascinating is the beauty of the bluish-green glow that an amateur chemist, making the trial with carbon tetrachloride, may quite conceivably (*Continued on page 246*)

Homemade Solution for Treating Burns

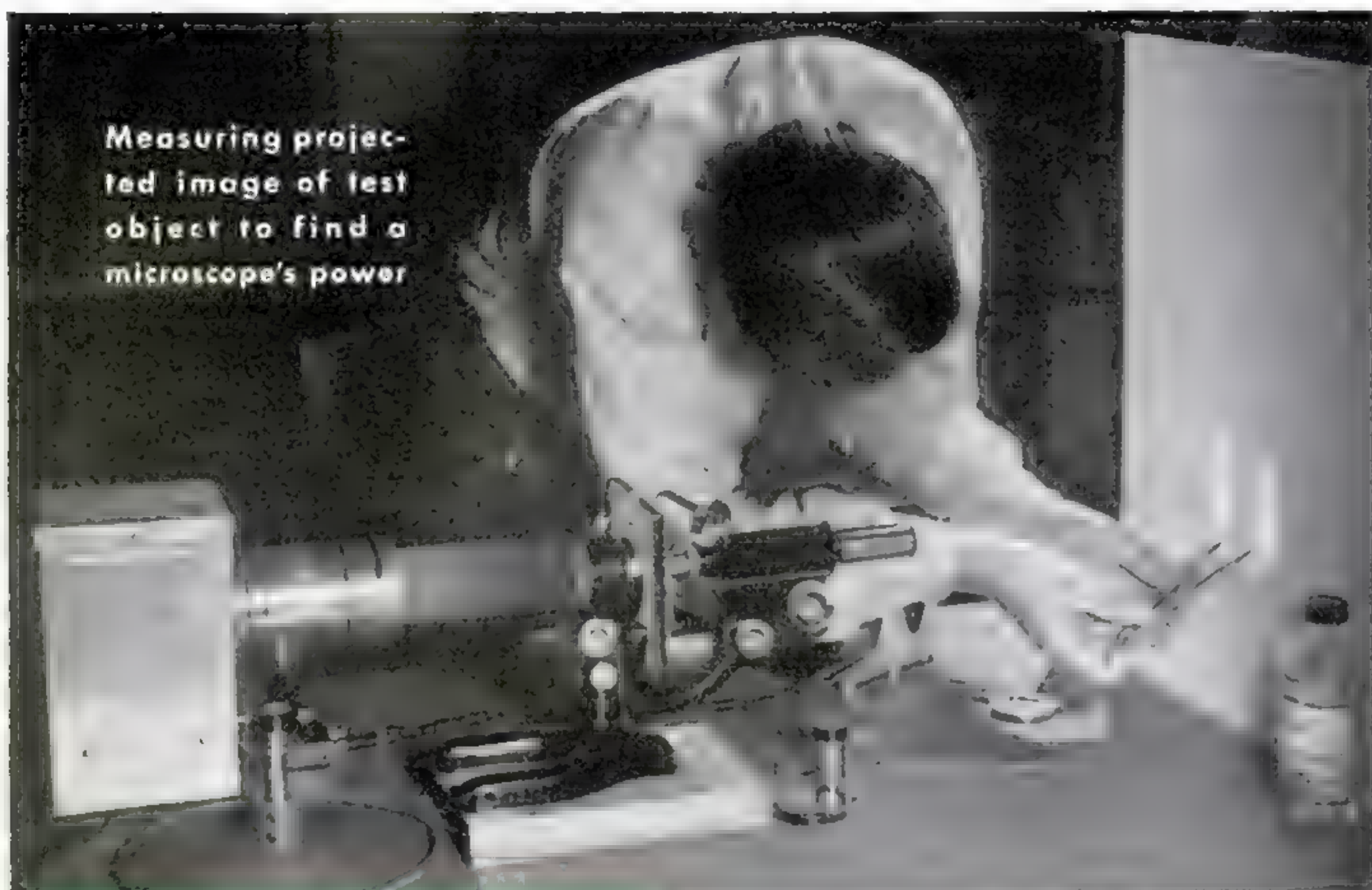
"SAFETY FIRST" in your home laboratory may well include a first-aid bottle of tannic acid solution for burns. To make up the preparation, dissolve one half gram of potassium chloride, one gram of calcium chloride, one gram of salicylic acid, ten and one half grams of sodium chloride, and 100 grams of tannic acid in 1,000 cubic centimeters (or thirty-four fluid ounces) of water. The salicylic acid serves as a preservative, while the chemical salts provide the necessary physiological balance with body fluids to aid in diffusion through the skin. A corked bottle holds the solution, and

a wad of absorbent cotton is used as an applicator. Cellophane and a rubber band will keep the cotton clean and handy, just above the cork, as shown. A red cross marks the bottle for quick identification.

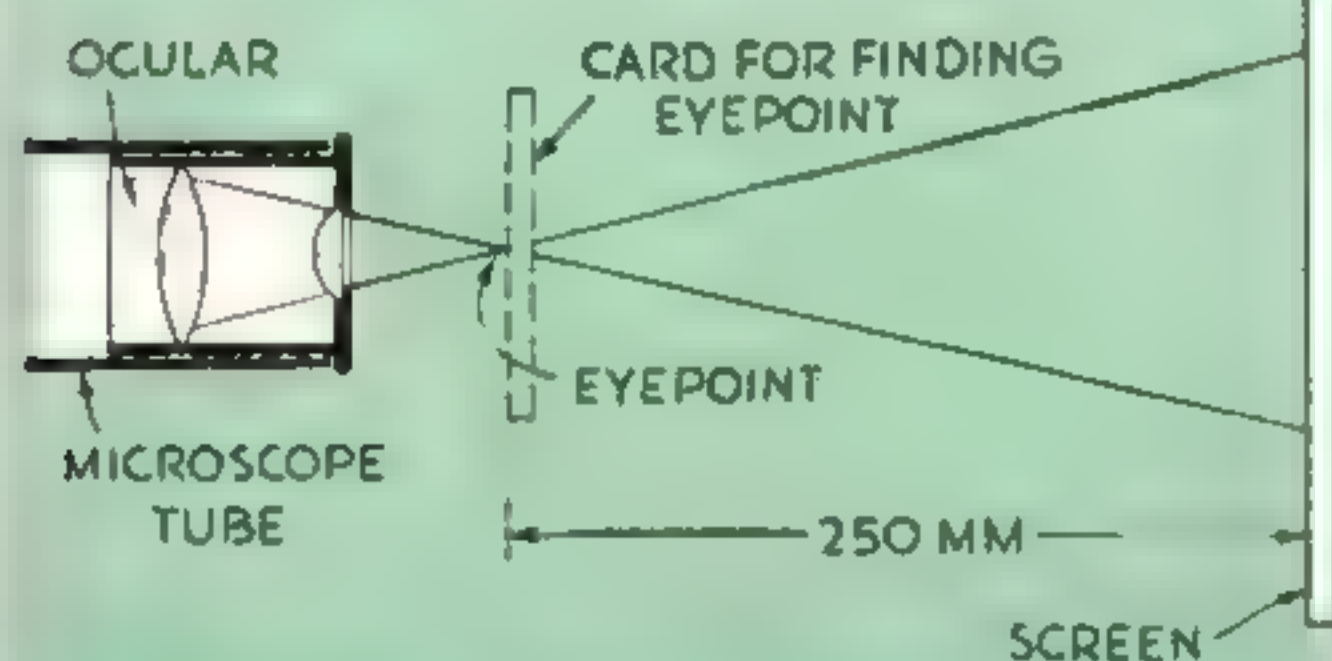


First aid for burns in the home laboratory. The solution, prepared as described above, is kept in a bottle with a handy wad of cotton attached for instant use

Microscope Questions...



Method of Finding Magnification



To find the "eyepoint" of your microscope, hold a piece of cardboard near the eyepiece while a strong light is passed through lenses

By MORTON C. WALLING

QUESTION-AND-ANSWER sessions are not confined to the radio. A lot of people ask questions about microscopes and the fascinating business of using them. With the thought that readers may find it helpful to know the answers to the questions I am most frequently asked, I am writing this month's article in question-and-answer form.

What is dioxan? Drug-store clerks say that they never heard of it

DIOXAN is a short name for diethyleneoxide. It is used in microscopy as a substitute for alcohol and xylol, being both a powerful dehydrating agent and a solvent for various substances including Canada balsam. When properly used in the preparation of botanical and other material for permanent mountings, it reduces considerably the time required to go through the process of extracting all water from the specimen; and it has been found, by various workers, that dioxan fixatives reduce "plas-

and Answers

PROBLEMS THAT WORRY THE AVERAGE LENS ENTHUSIAST

molysis," or distortion of the specimen during fixation and extraction of water. Use of dioxan has been explained in various articles in this series, and further information can be found in technical literature. The best place to obtain this useful reagent is at a chemical supply house or from the manufacturer.

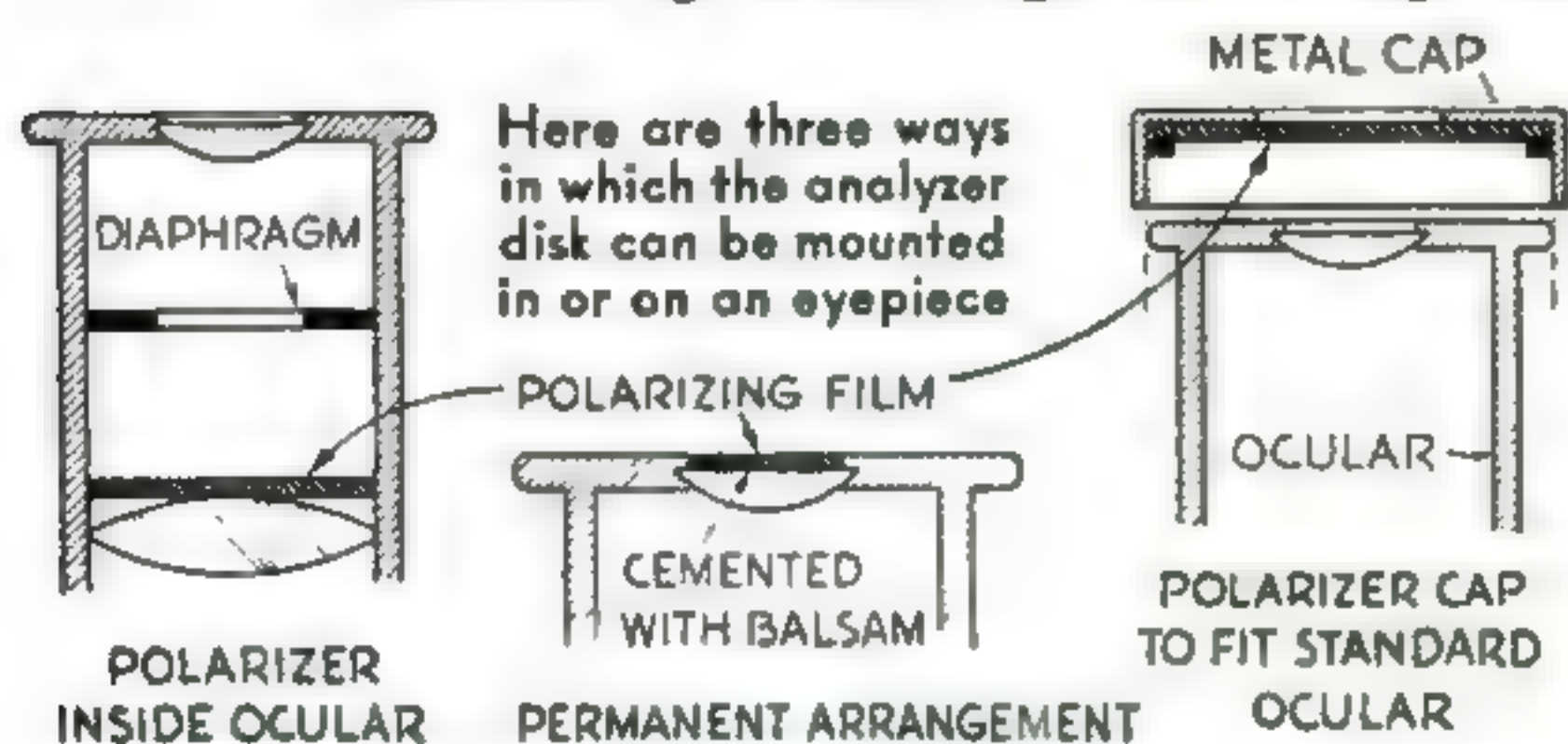
How can I determine the magnifying power of my microscope?

THIS is one of the most commonly asked questions. If you know the magnifying power of your objective and of your eyepiece (ocular), the total magnification is obtained by multiplying one by the other. Thus a 5X eyepiece and a 10X objective will give a magnification of fifty.

When the powers of the lenses are not known, the process is not quite so simple. The usual way is to employ optical measuring devices such as micrometers; but few amateurs have access to such equipment. The following method is easier, costs nothing and can be very accurate:

Place the microscope in a darkened room and arrange a screen so that the image formed by the lenses can be projected on it. A sheet of white cardboard will do. Use a strong enough source of light to form an image on the screen. A microscope illuminator of the type that has a high-intensity lamp and condenser lenses is best; or a lantern-slide or motion-picture projector, suitably adjusted, can be used. With a small piece of white cardboard or paper, find the eyepoint of the ocular, which is the point where the circle of light is small and most sharply defined. This is a few millimeters from the ocular lens. By careful measurement, adjust the microscope until the distance from the screen to this eyepoint is 250 mm. (approximately 10"). Project the image of an object of known size on the screen. Usually a stage micrometer, which is a scale ruled on glass, is used; but such measuring devices are rather costly. For low magnifications, a transparent millimeter scale can be used. For higher powers, where the field of view does not cover two marks on the scale, use a piece of fine wire

Method of Mounting Polarizing Sheet Material



Inserting a polarizing disk in the filter ring beneath the condenser of a standard microscope. Left, disk being placed over lower eyepiece lens as analyzer



This is a low-power, Greenough-type binocular microscope. It has twin objectives and gives a stereoscopic effect of depth

or some other object whose width can be measured accurately with a machinist's micrometer. If you have no micrometer, take the wire to a hardware store or machine shop and ask some one to do the measuring with the necessary instrument.

Project the image of the test object on the screen, and with dividers or a scale measure accurately its width, or the distance between two reference points. To find the microscope power, simply divide the distance measured on the screen by the actual size of the object. As an example, if the piece of wire is 0.010" in diameter and its image is 4" wide, the magnification is $4/0.010$ or 400 times.

How can I take yellowed balsam off slides and cover glasses?

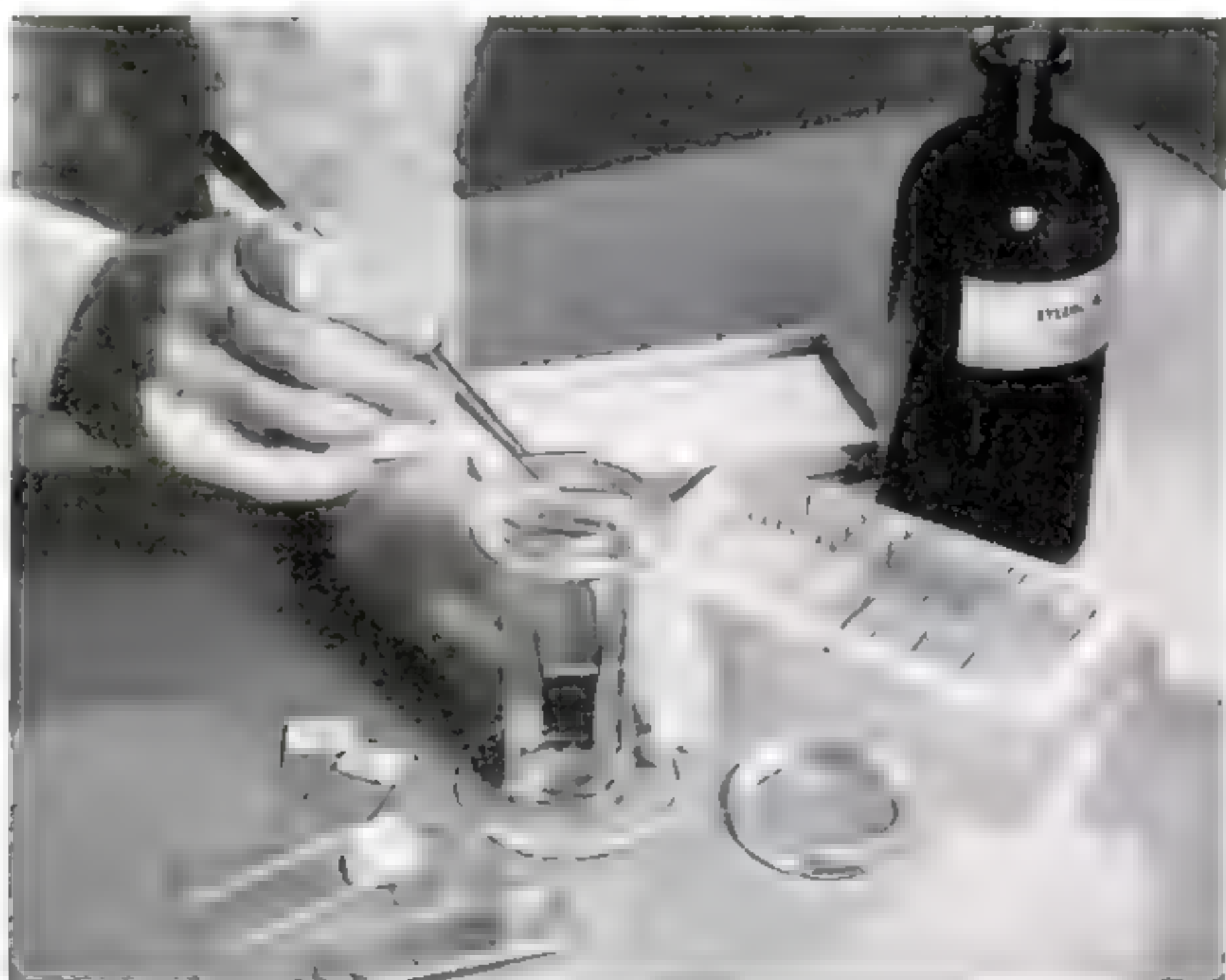
ANY solvent of balsam, such as xylol and some lacquer thinners, can be used to clean the glass, provided the slides are immersed in it

long enough. Use a covered glass container, and arrange the slides so they are completely surrounded by the liquid. Sometimes heat can be used to loosen cover glasses, and solvent then employed to clean them and the slides.

How can I mount sheet polarizing material on my microscope to make it a polarizing instrument?

THE polarizing material referred to comes in the form of transparent sheets, looking much like photographic film. A 2" by 2" piece of it, sufficient for making two or three polarizing sets, can be obtained for a dollar. The polarizing unit of a polarizer-analyzer pair is placed between the light source and microscope stage. Many instruments have a substage ring for holding filters and dark-field stops. When this ring is present, cut a disk of the polarizing material to fit it, the standard being 33 mm. in diameter. Although, with careful handling, no rim or other protection is required for this polarizing disk, it is a good idea to protect

it by sandwiching it between two thin disks of glass or some transparent plastic material. When there is no filter ring on the microscope, you can use a square or circular piece of the polarizing material, and support it in some convenient way directly



Balsam is removed from old slides and cover glasses by soaking in xylol. The jar shown above has grooves to hold the slides apart

below the stage, or over the mirror.

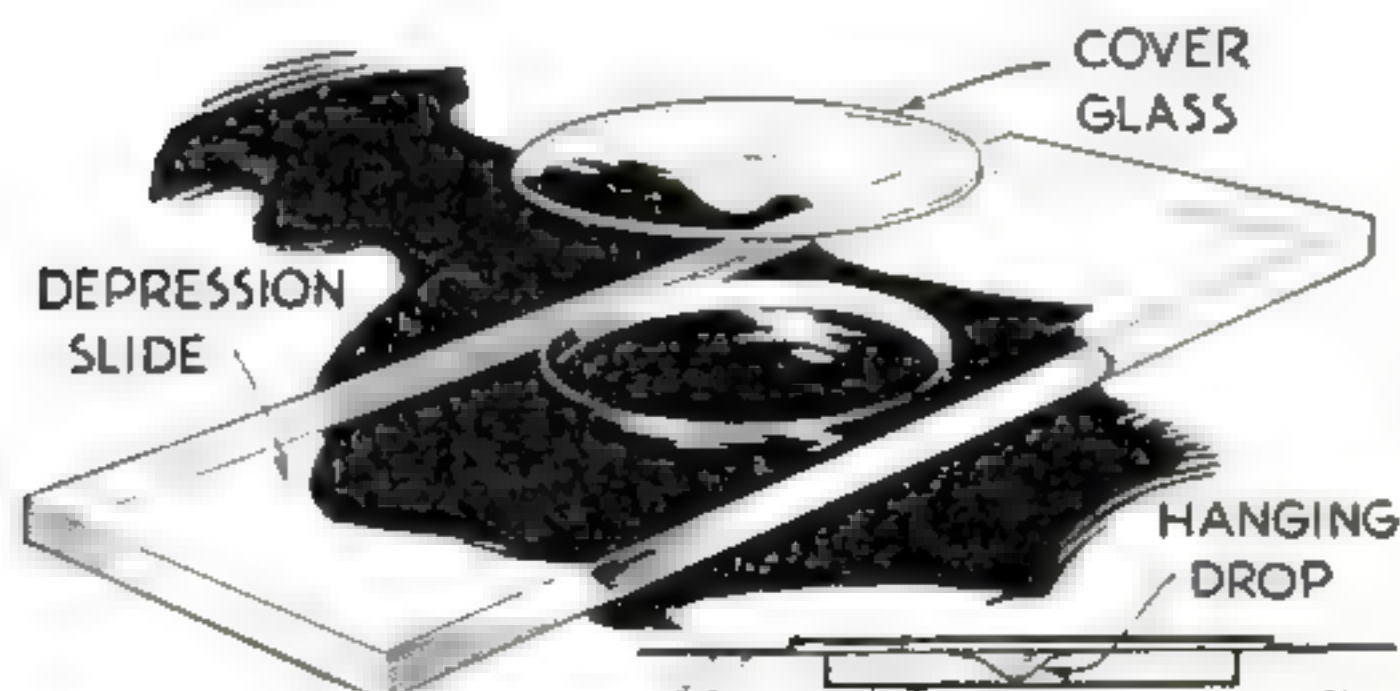
The analyzer is a piece of the polarizing material placed in the light beam at the eyepiece end, and must be easily rotated. In most microscopes, the best way to make an analyzer is to cut a polarizing disk to a size that will permit it to be dropped inside the eyepiece so it rests on the lower lens. Do not place it on the diaphragm, which is about midway between upper and lower lenses of the eyepiece.

What is a binocular microscope? Is it better than the ordinary kind?

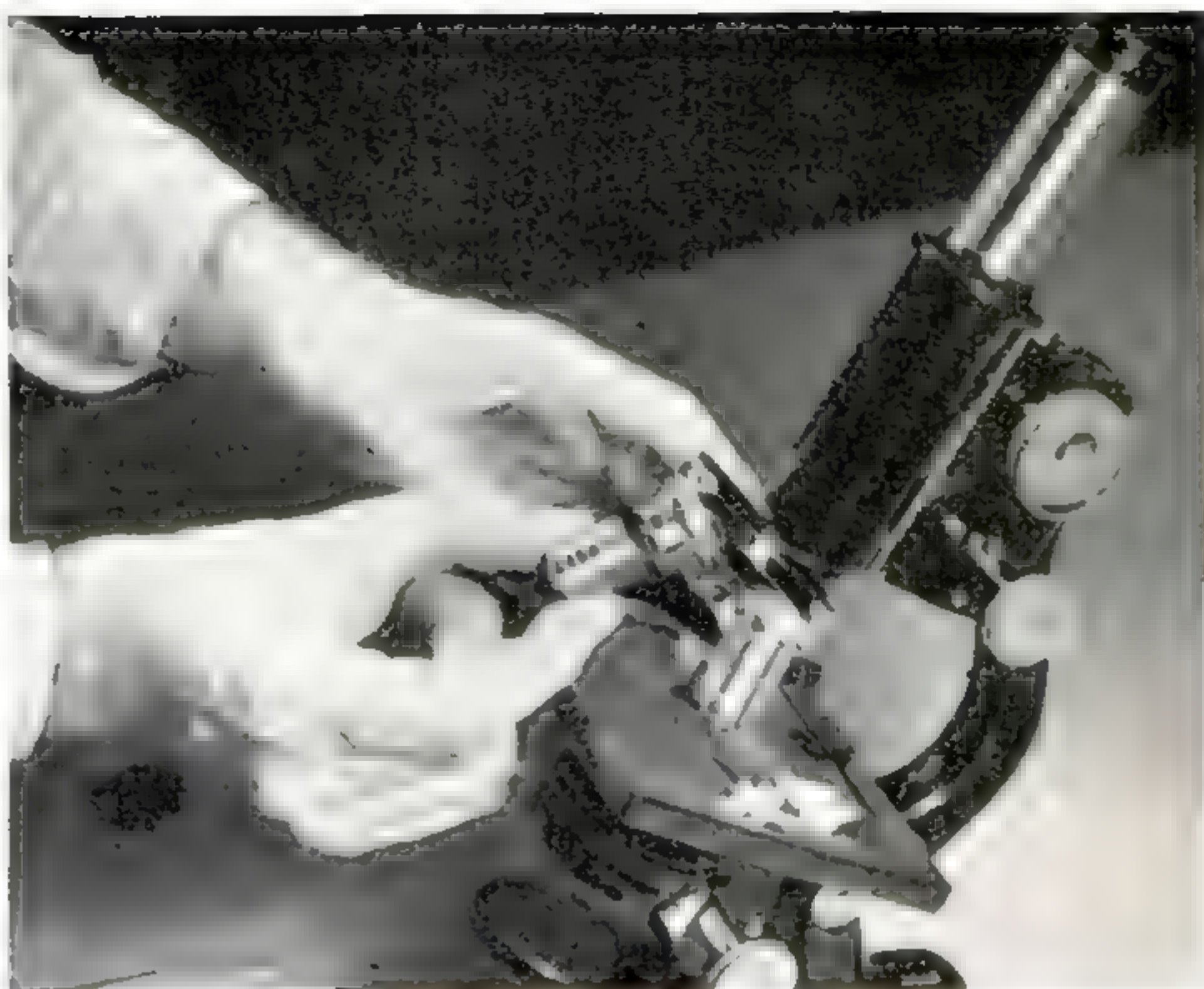
A BINOCULAR microscope has two eyepieces instead of one, so the observer uses both eyes at once. There is some argument about the advantages and disadvantages. Most microscopists agree, however, that a binocular instrument is less fatiguing to the eyes and permits the user to see more detail. There are two general kinds of binoculars. First the Greenough type that has twin objectives and gives stereoscopic images. Its magnification range is limited because of the two objectives, but it is excellent for studying stamps, coins, and similar subjects. Binocular microscopes having single objectives can be made in any power that a monocular instrument can, and can be arranged to give either a stereoscopic image or simply binocular vision without the perception of depth.

What magnification is needed to show fat globules in rather fresh milk?

THE laboratory of a city dairy company reports that 100 diameters is sufficient for such work. This would be given by a



To study fat globules in fairly fresh milk, a drop is suspended from a cover glass on a special slide



With this divisible objective, initial magnification can be reduced from 10X to about 4X by removing the end as seen in the picture above

standard 16-mm. objective and 10X eyepiece. The milk is mounted in a hanging-drop slide. That is, the slide is rather thick and has a hole or depression in it. The drop of milk is placed on a cover glass, which is then inverted over the hole so the milk hangs suspended without touching the slide.

How can I get two degrees of magnification in a microprojector with a single objective?

YOU can, of course, vary the magnification by changing eyepieces or altering the distance from projector to screen. When you find it inconvenient to do either of these, you can use a divisible objective. For instance, you can get a 10X (16-mm.) objective from which the end can be removed to give about 4X magnification.

Is Canada balsam the only mounting medium for microscope specimens?

CANADA balsam happens to have almost exactly the same index of refraction or light-bending power, as glass used in making slides and cover glasses. So an object mounted in it appears the same as if it were embedded in the glass. Also, balsam is cheap and easy to handle. It preserves specimens a long time, and does not itself deteriorate noticeably except to the extent of yellowing with age. If necessary, specimens in old balsam can be cleaned and re-mounted. However, there are numerous other mounting media. Glycerin and glycerin jelly can be (Continued on page 249)

SEEING NATURE'S



Toy Globe Makes Model of Earth's Magnetism

WIND a dozen turns of bell wire around the equator of a toy sheet-iron terrestrial globe, connect the ends of the wire to dry cells, and you will have a working model of the earth's magnetism. A compass or a dipping needle, used to explore the model, behaves just as it would at the corresponding point on the surface of the earth, aside from a small discrepancy because the earth's geographic and magnetic poles do not quite coincide.

Lamp Bulbs Demonstrate Laws of Resistance

WHEN the two are connected in parallel, or the usual way, a sixty-watt bulb gives about twice as much light as a thirty-watt bulb. Connect them in series, as shown above, and the thirty-watt bulb will light up brightly, while the bulb of sixty-watt rating barely glows! When resistances are connected in parallel, the greatest heating effect is produced in the unit of least resistance (in this case, the sixty-watt bulb); when they are connected in series, in the unit of greatest resistance (in this case, the thirty-watt bulb). And the more heating effect, the more light.



Exploring the magnetized globe, a compass acts as it would at the corresponding points on the earth

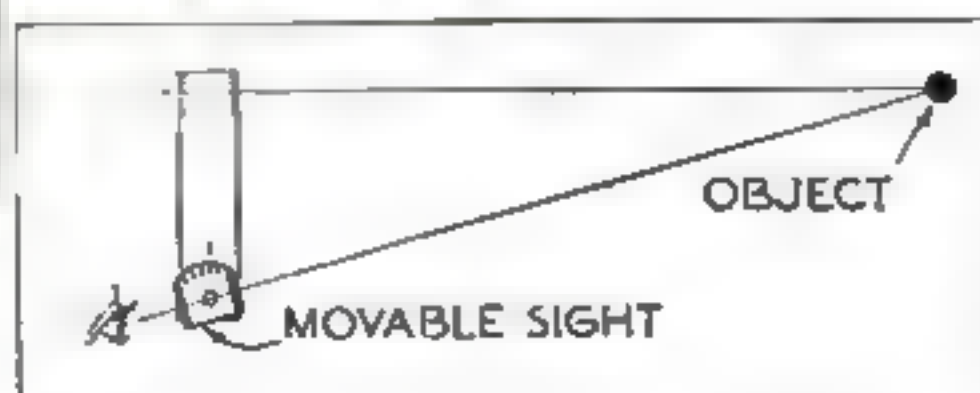
Cardboard Model Shows How Range Finders Work

TO DEMONSTRATE the principle of the range finders used by photographers and military observers, mount cardboard sights, made as shown, on a cardboard base. One sight should be fixed and at right angles to the base. Attach the other sight, with a thumb tack, so that it may be rotated. Turn the whole model until the fixed sight is trained upon the object whose distance is to be found. Then rotate

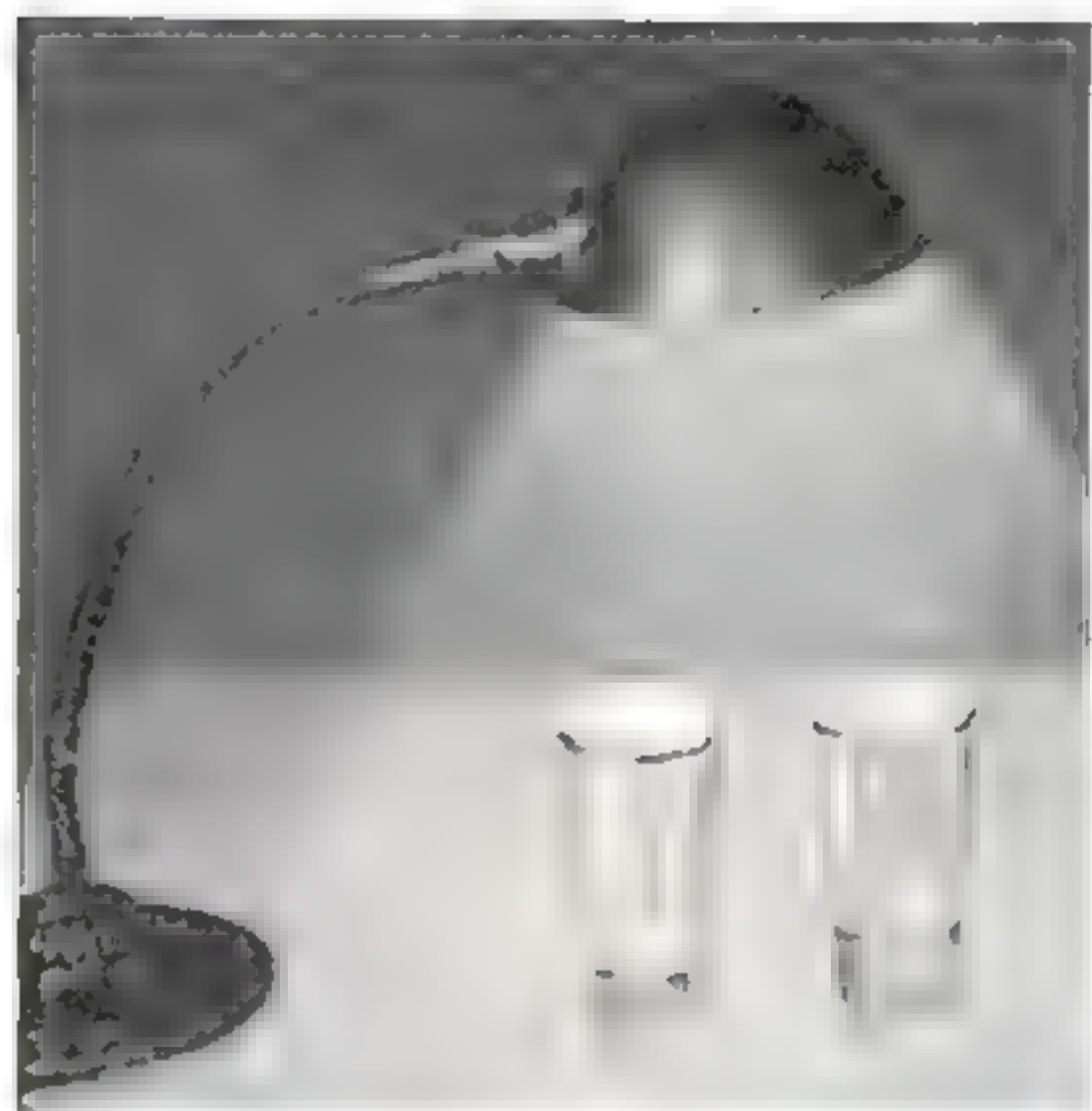
the movable sight until it is also lined up with the object. The distance to the object may then be calculated from the angle of the movable sight, or read from a scale.



Measuring distance with the model range finder. Drawing illustrates the principle



LAWS IN ACTION



What Is "Specific Heat"?

HEAT an ordinary flatiron over a gas flame, until a drop of water boils on touching it. Over the same flame, for the same length of time, heat an equal weight of water (a gallon weighs eight pounds). Instead of boiling, the water will still be cool enough to put your hand in. You must put more heat into some substances than others to raise their temperatures equally, and the relative amount is called their "specific heat." The specific heat of water is nine times that of iron.

Why Dirty Snow Melts Faster Than Clean

COVER two tumblers with pieces of wire screening and place on them equal quantities of snow, one clean and the other sooty. Set an electric lamp midway above the tumblers, and watch the melting race, which the sooty snow always wins. The dark material absorbs heat from the lamp, melting this portion of snow first, while the clean, white snow reflects heat off its surface and so lasts longer.



Iron heats nine times as fast as the same weight of water

Compass Needle Swings Like a Pendulum

LIKE a pendulum acted on by gravity, a compass needle oscillates when suddenly placed in a magnetic field, with a definite frequency that depends upon the strength of the field. It will swing slowly back and forth when approached with a bar of iron, reacting to the very weak field set up by its own magnetism. A small magnet produces faster oscillations, depending on the distance between magnet and compass.

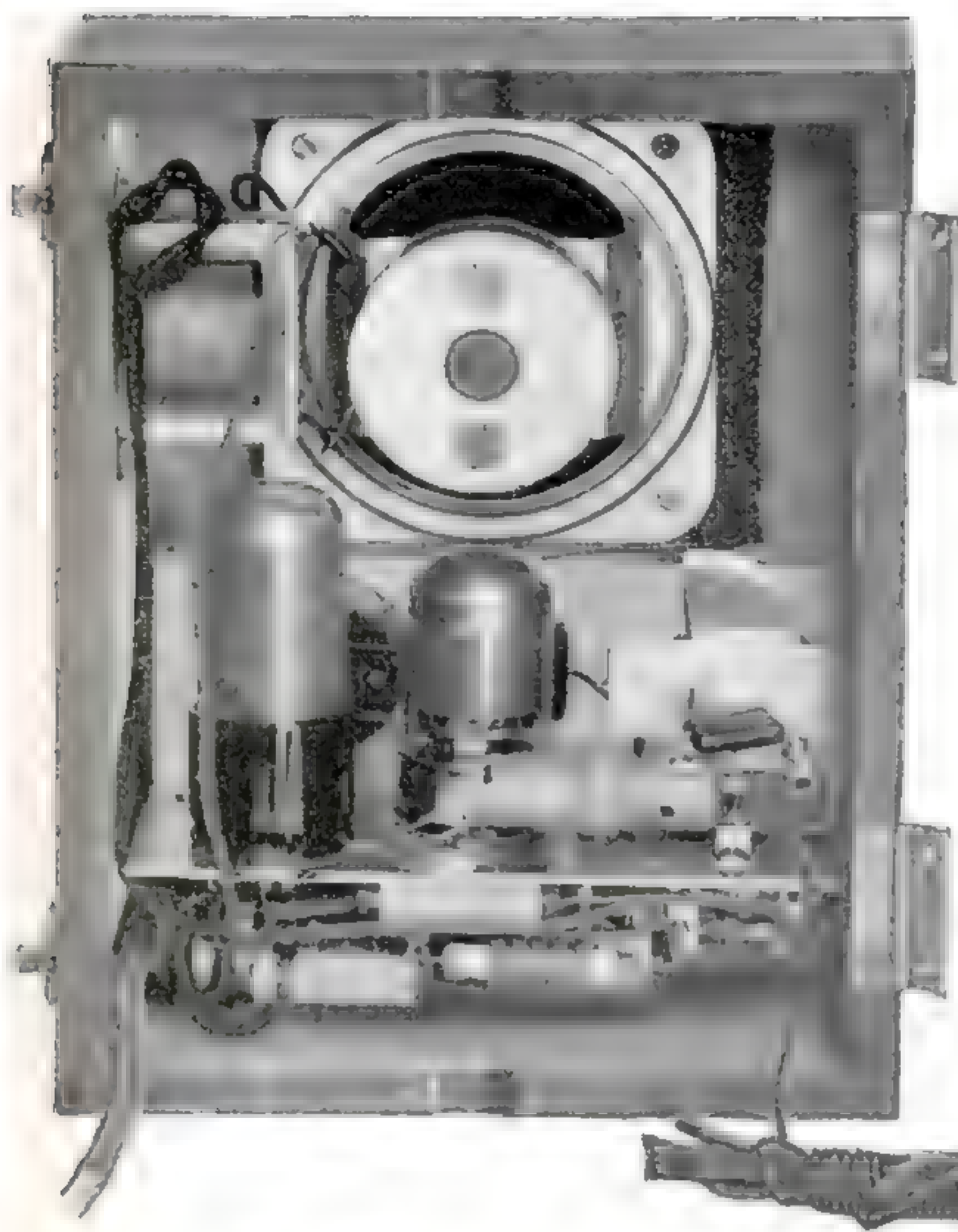
Seeing Through a Fence

STANDING still, you can see little through the openings in a picket fence—but if you move rapidly past, you get a good view of what lies beyond. "Persistence of vision," the phenomenon applied in the movies, retains and fuses together your glimpses.



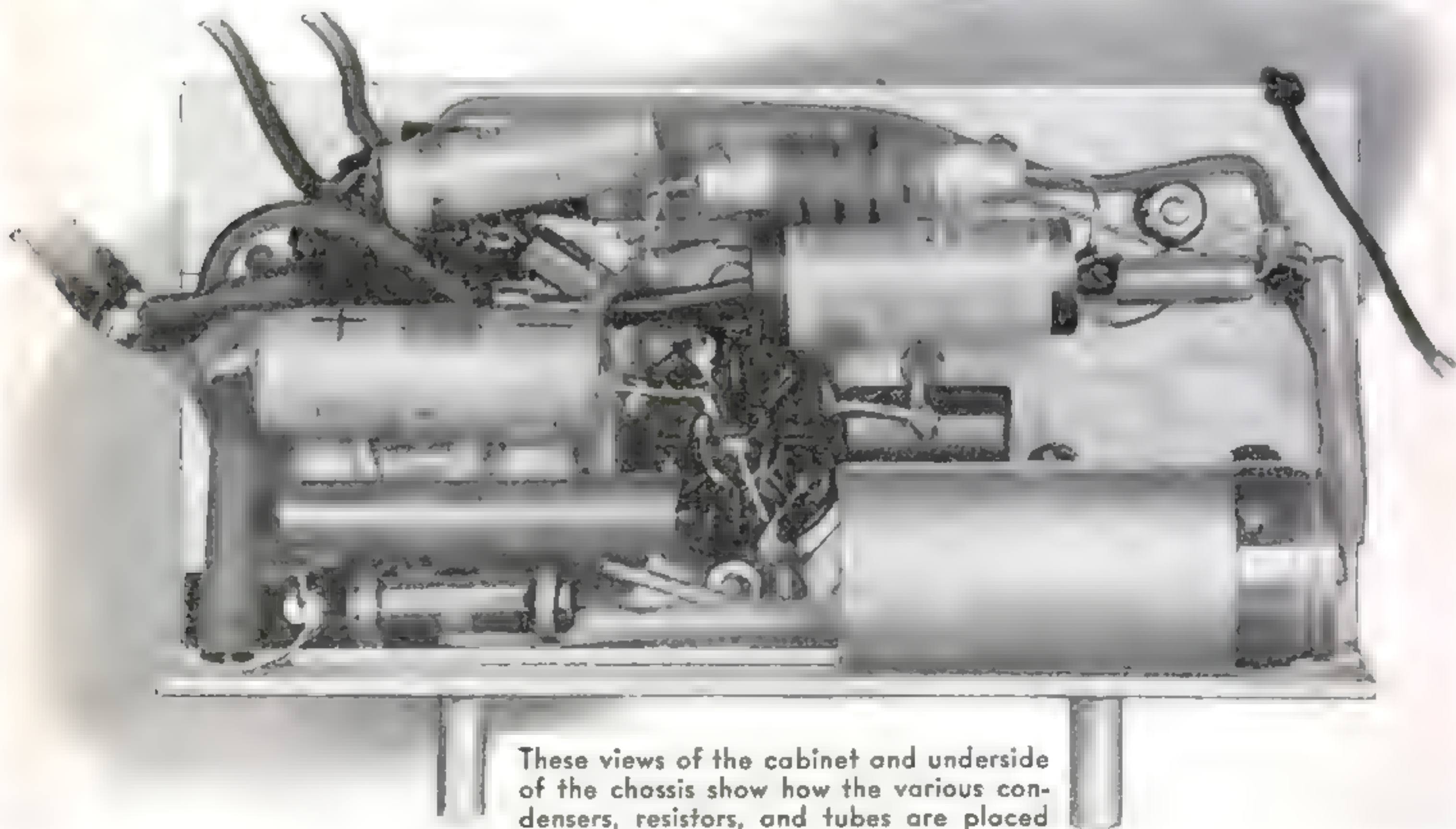
A magnet makes the compass needle swing rapidly

A Radio for Your Floor Lamp



DESIGNED so that it can be attached to the standard of any floor lamp, the radio set illustrated forms a handy auxiliary receiver for living room, bedroom, or den. Mounted on a bridge lamp it provides a radio for card games; attached to a floor lamp beside your favorite chair it puts the evening's programs at your finger tips; and fastened to a standing lamp in your bedroom it serves as a convenient bedside set. Since the receiver's cabinet simply is clamped around the lamp's standard, as shown in the photographs, the absence of exterior fittings or brackets also makes it possible to use the unit as a conventional table radio. The compact receiver requires no external ground, and can be operated with nothing more than a short indoor antenna.

There is nothing particularly complicated about the A.C.-D.C.



These views of the cabinet and underside of the chassis show how the various condensers, resistors, and tubes are placed

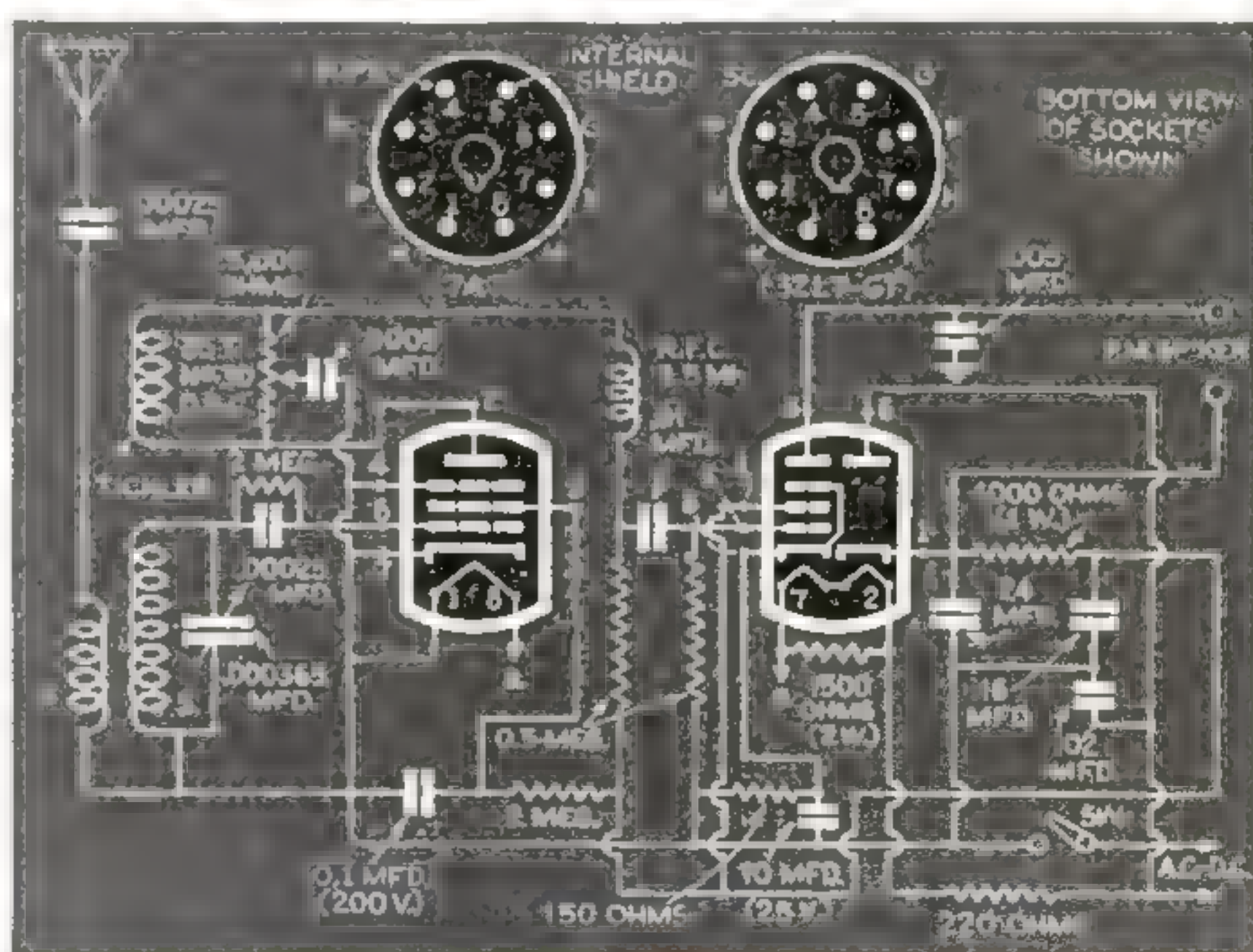
By ARTHUR C. MILLER

circuit, which is unusually sensitive and free from hum. Only two tubes are used. One of the new locking-type-base pentode tubes (7A7) was chosen as the detector. It is resistance-coupled to a combination output pentode and half-wave rectifier (32L7). No grid cap is provided on the detector, as these new tubes are of the single-end construction, the grid connection being brought out at the base. Because the rated heater voltage of the 7A7 is slightly higher than that of the 32L7, a 2-watt resistor of approximately 1,500 ohms must be placed across the heater connections on the base of the 32L7. The resistor can be soldered directly to the lugs of the socket.

To save space, no filter choke is used. Instead, a 1,000-ohm, 1-watt resistor is connected between the dual electrolytic condenser (16-24 mfd.). This provides adequate filtering and allows the necessary voltage to get through to the plate of the tubes. A larger resistance cannot be used without an appreciable loss in volume.

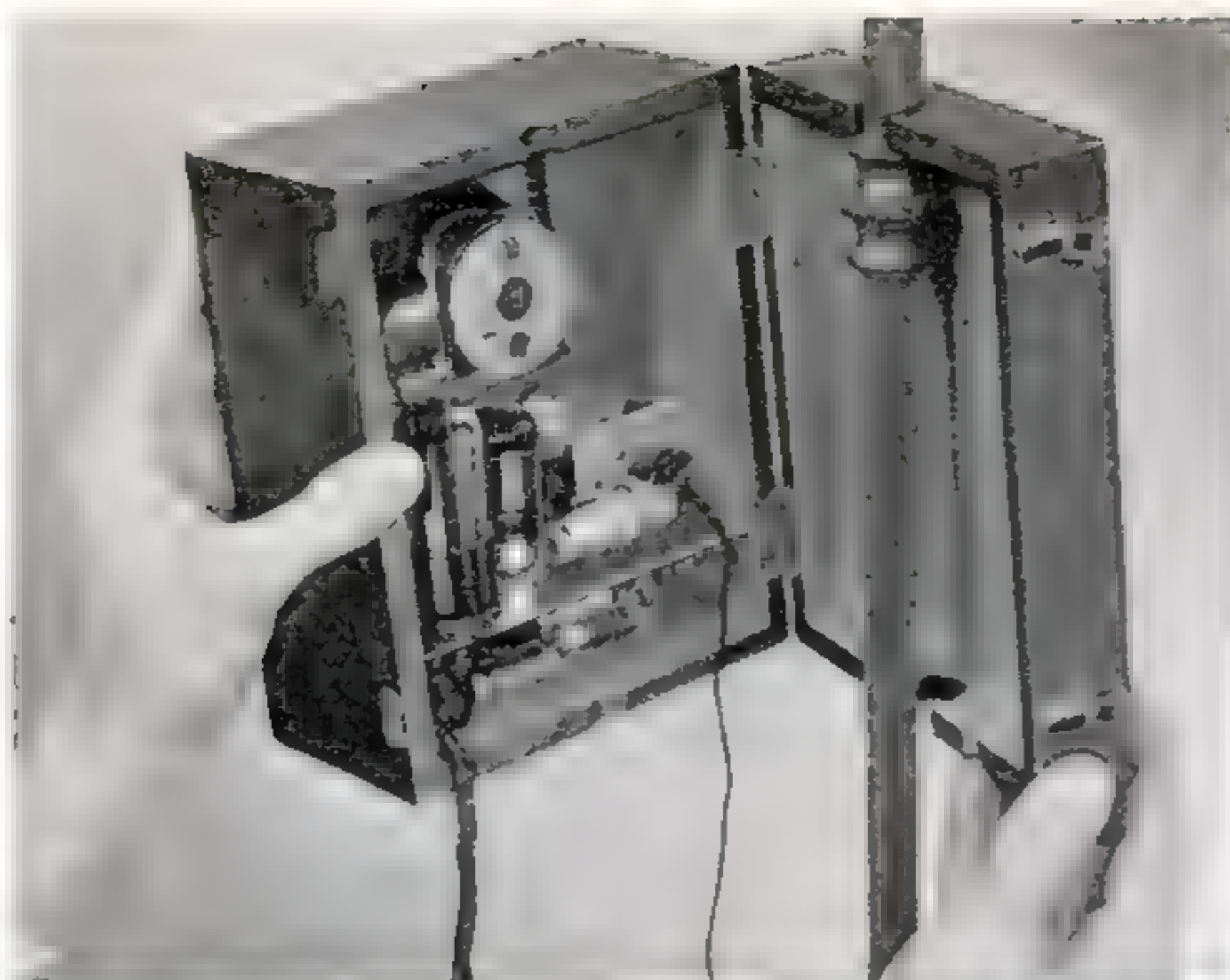
The .00025-mfd. mica condenser indicated in the antenna lead is *extremely important*, since it eliminates any possibility of blowing out the tubes or burning the primary of the antenna coil (which could start a fire) should the antenna wire or antenna lead accidentally come in contact with a grounded pipe or radiator.

The hinged mahogany cabinet measures 4 $\frac{3}{4}$ " by 6 $\frac{1}{4}$ " by 8", the lid being 1 $\frac{1}{4}$ " deep (this is included in the overall depth of 4 $\frac{3}{4}$ "). The sides are constructed of $\frac{3}{8}$ " wood, while the front and sides were cut from $\frac{1}{4}$ " wood. When completed the whole box was stained a deep mahogany, waxed, and then polished. The



Easily built, the set can be clamped to the upright of any floor lamp

sides of the 3 $\frac{1}{4}$ " diameter opening for the speaker are beveled outward to give a more finished appearance to the cabinet, and a square of gold silk glued in place behind



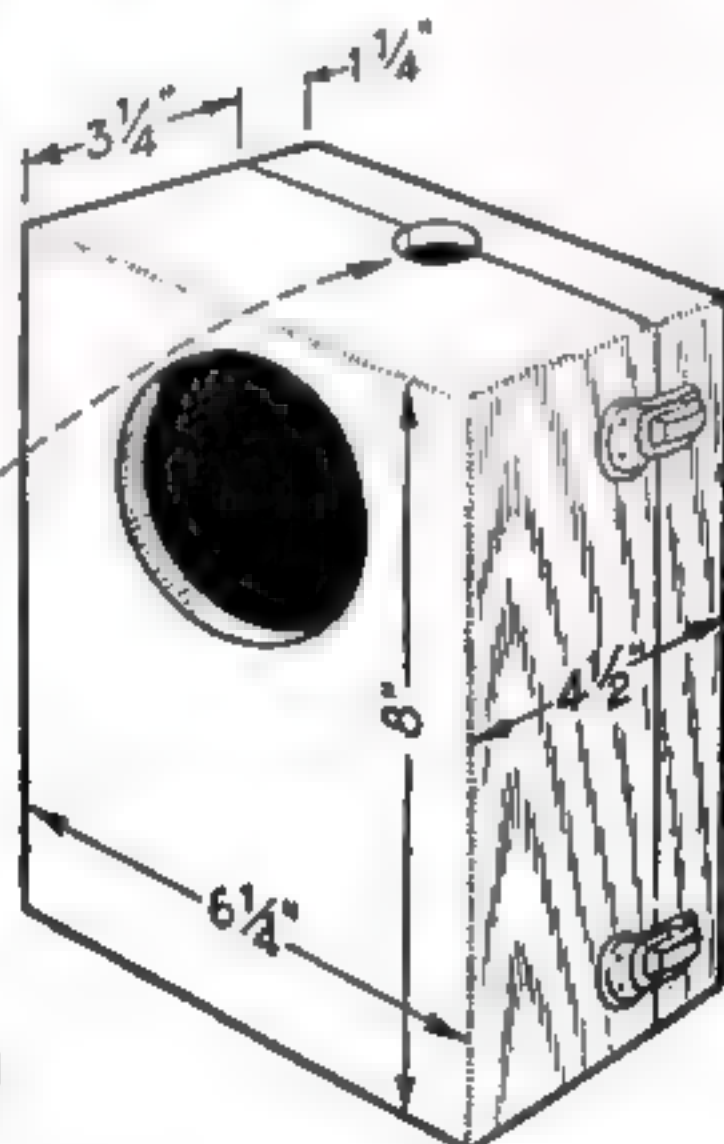
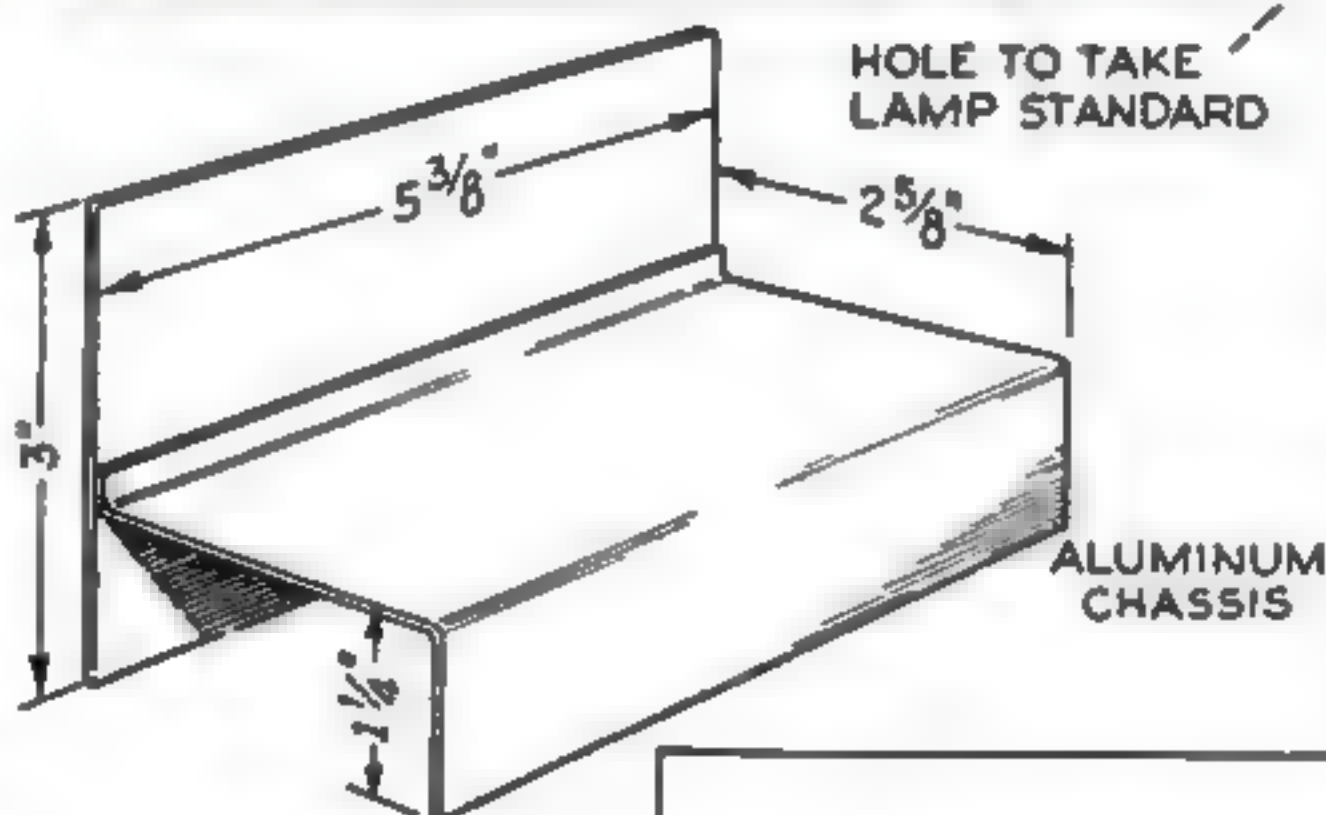
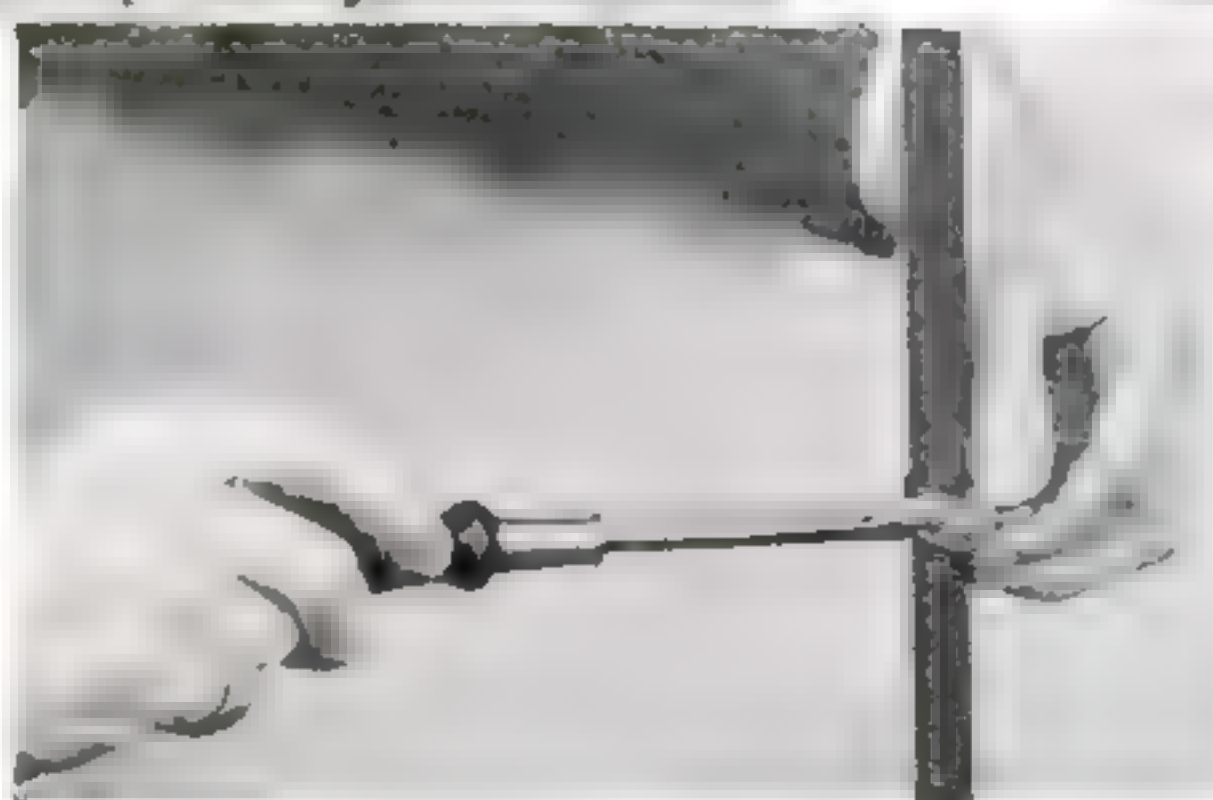
Either a decorative "bead" on the standard or a hose clamp can be used to support the mahogany cabinet shown in the drawings below, right

the opening serves as an attractive grille.

As indicated in the photographs and drawings, the parts, with the exception of the speaker and output transformer, are mounted on a small aluminum chassis and panel. The output transformer, separate from the speaker, can be fastened with screws to the side wall of the cabinet. In wiring the tubes, pay close attention to the accompanying socket diagrams, particularly the diagram for the new 7A7 tube. Watch the power connections to the resistor line cord. The 220-ohm resistance must be wired into the heater circuit to reduce the full 110-volt house current to the value required for the two heaters. A wrong connection at this point can blow out both tubes.

Holes cut in the top and bottom edges of the hinged lid and main cabinet serve to take the lamp standard. Naturally, the diameter of these holes will be governed by the size of the standard.

When using the receiver with direct current, remember that the house-wiring receptacle has a positive and a negative terminal. For this reason, it may be necessary to reverse the power plug to obtain the proper polarity.



LIST OF PARTS

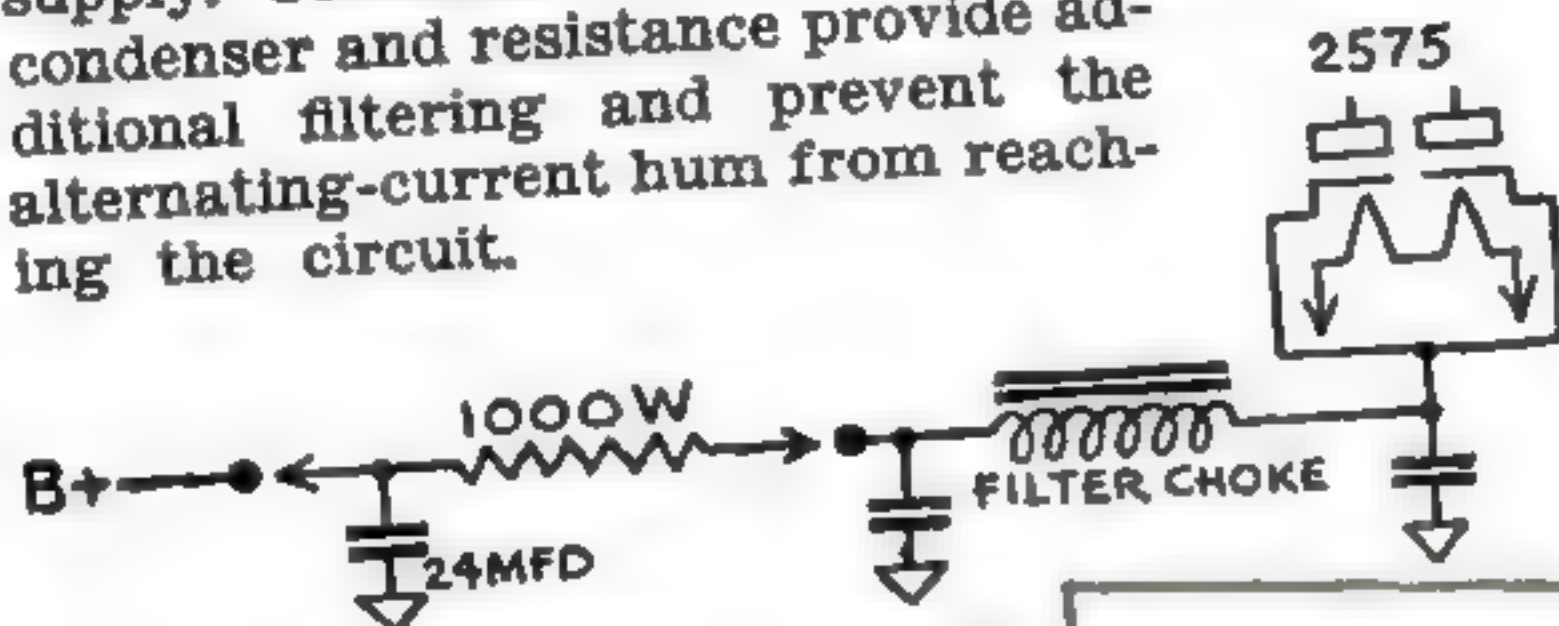
Midget tuning condenser, .000365 mfd.
Midget antenna coil.
Radio-frequency choke, 2.5 mh.
Resistor, 1,000 ohm, 1 watt.
Resistor, 1,500 ohm, 2 watt.
Resistors, two, 500,000 ohm, 1/2 watt.
Resistors, two, 2 megohm, 1/2 watt.
Resistor, 150 ohm, 1 watt.
Condenser, tubular, .1 mfd., 200 volt.
Condenser, tubular, .02 mfd., 200 volt.
Condenser, tubular, .01 mfd., 200 volt.
Condenser, tubular, .005 mfd., 200 volt.
Condensers, two, mica, .00025 mfd.
Condenser, mica, .0005 mfd.
Electrolytic condenser, dual, 16-24 mfd.
Loudspeaker, 3" permanent-magnet type.
Output transformer for speaker.
Line cord and resistor, 220 ohms.
Volume control and switch, 25,000 ohms.

Miscellaneous: Cabinet, chassis, 7A7 tube, 32L7-GT tube, sockets, wire, lugs, solder, knobs, grille cloth, etc.

Trouble Shooting

FOR RADIO AMATEURS

1 EXCESSIVE HUM in a conventional A.C.-D.C. receiver generally can be effectively killed by inserting a 24-mfd. electrolytic condenser and a 1,000-ohm, 1-watt resistor in series with the filter choke in the receiver's power supply. Connected as shown in the diagram, the condenser and resistance provide additional filtering and prevent the alternating-current hum from reaching the circuit.

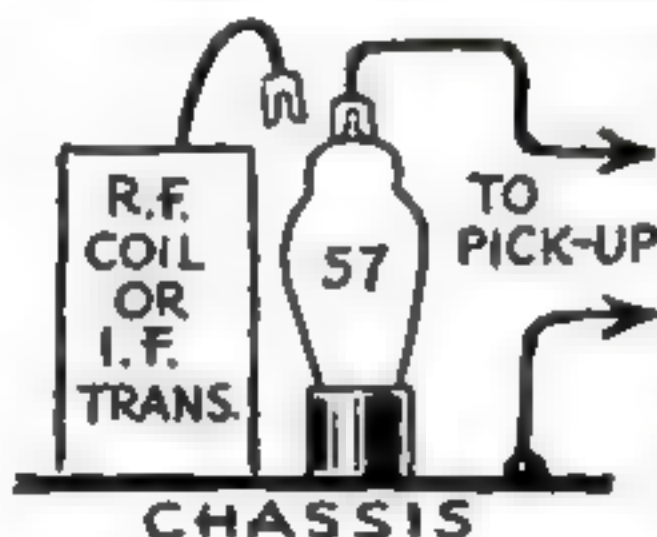


ARE you having trouble with your broadcast or short-wave receiver? If you are, study the cures given on this page. They cover seven of the most common radio ailments affecting commercial as well as home-built circuits. In each case, the trouble can be cured easily and quickly.

2 CODE SIGNALS can be eliminated when using a super-heterodyne receiver by connecting a 456-kc, iron-core I.F. wave trap in series with the antenna lead-in to the set. The wave trap can be mounted inside the cabinet where it can be adjusted easily with a screw driver.

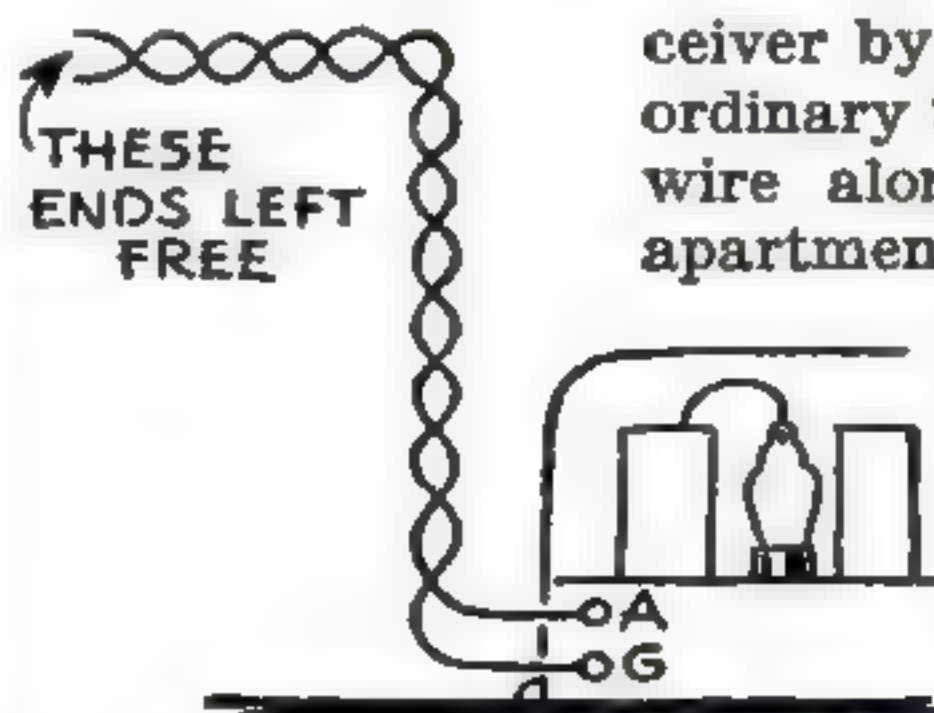
3 INTERFERENCE and jamming on the short-wave bands of all-wave set can be reduced greatly by using a crystal filter unit, which can be mounted directly on the chassis of the receiver, in place of one of the regular 456-kc, I.F. transformers in the circuit.

4 A PHONOGRAPH PICK-UP can be added quickly and easily to any receiver by disconnecting the existing lead to the grid of the detector tube (such as a 57, 6C6, or 6J7) and attaching one of the leads from the pick-up to the grid and the other to any convenient point on the chassis. The drawing above illustrates this simple wiring stunt, which makes short work of an ordinarily troublesome operation.



5 NOISY TUNING and oscillation at the high frequencies may be caused by corroded and dirty tuning-condenser rotor contacts. The rotor shaft should be connected directly to the chassis to insure a perfect repair job and insure the best possible reception by the set.

6 A SUDDEN INCREASE in the volume of a receiver when lights are switched on in rooms near the set is usually caused by one or more faulty tubular condensers. The sudden surge of current peps up the condenser temporarily. This, of course, can be remedied only by replacing the faulty condenser.



7 STATIC caused by a nearby electric generator often can be reduced in a D.C. receiver by running about 50' of ordinary twisted electric house wire along the walls of the apartment and connecting the two ends to the antenna and ground posts on the receiver, in place of the antenna and ground.

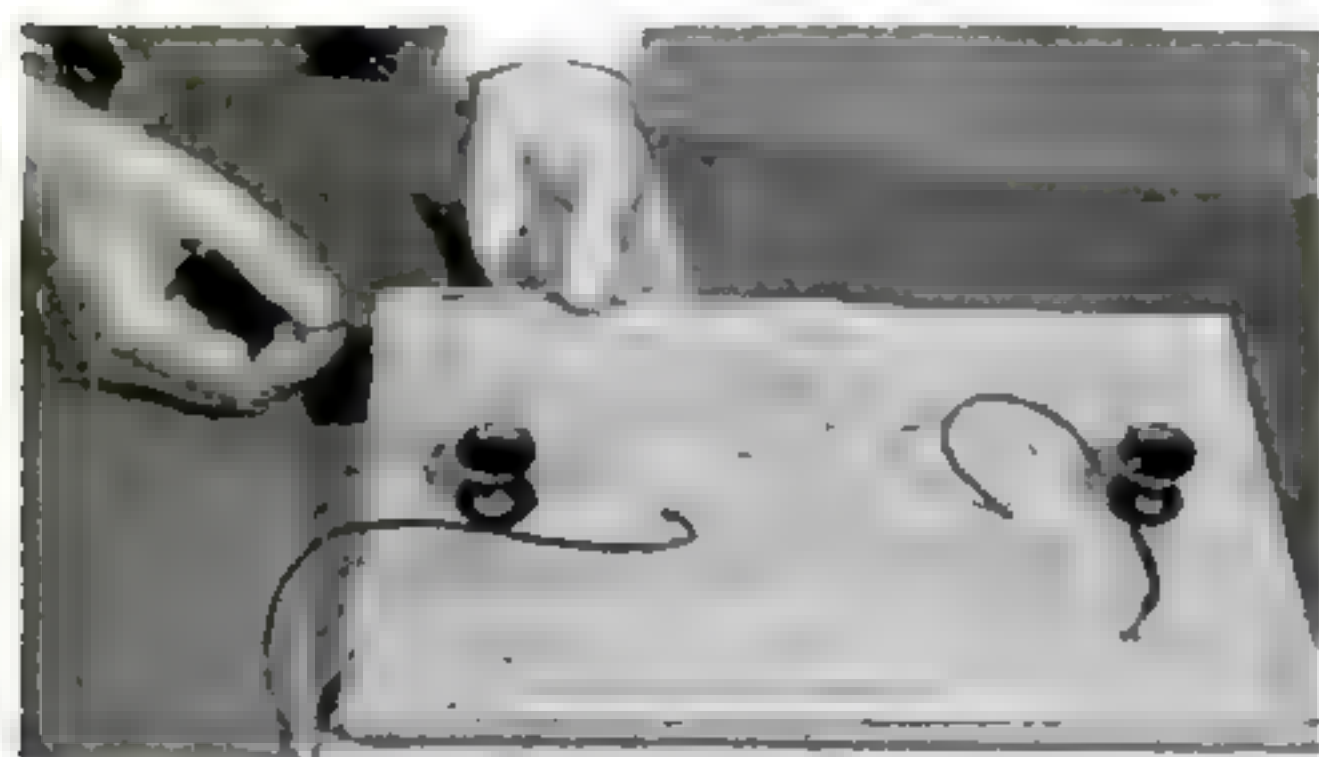
WHAT'S NEW IN THE

Amplifier Is Carried in Mike

MOUNTED within its own microphone housing, the amplifying system that operates a new hearing aid for the deaf represents the maximum in compactness. It may be carried in the hand, or worn in a vest pocket or beneath a lapel. Although the housing is unusually small in itself, it contains, besides the microphone and a three-tube amplifier, a volume control and a tone control. The outfit's midget earphone is shown at the left of the photograph at the right. The only additional equipment needed is a pocket-type battery.



Built into this hearing-aid microphone is a complete audio-amplifier circuit



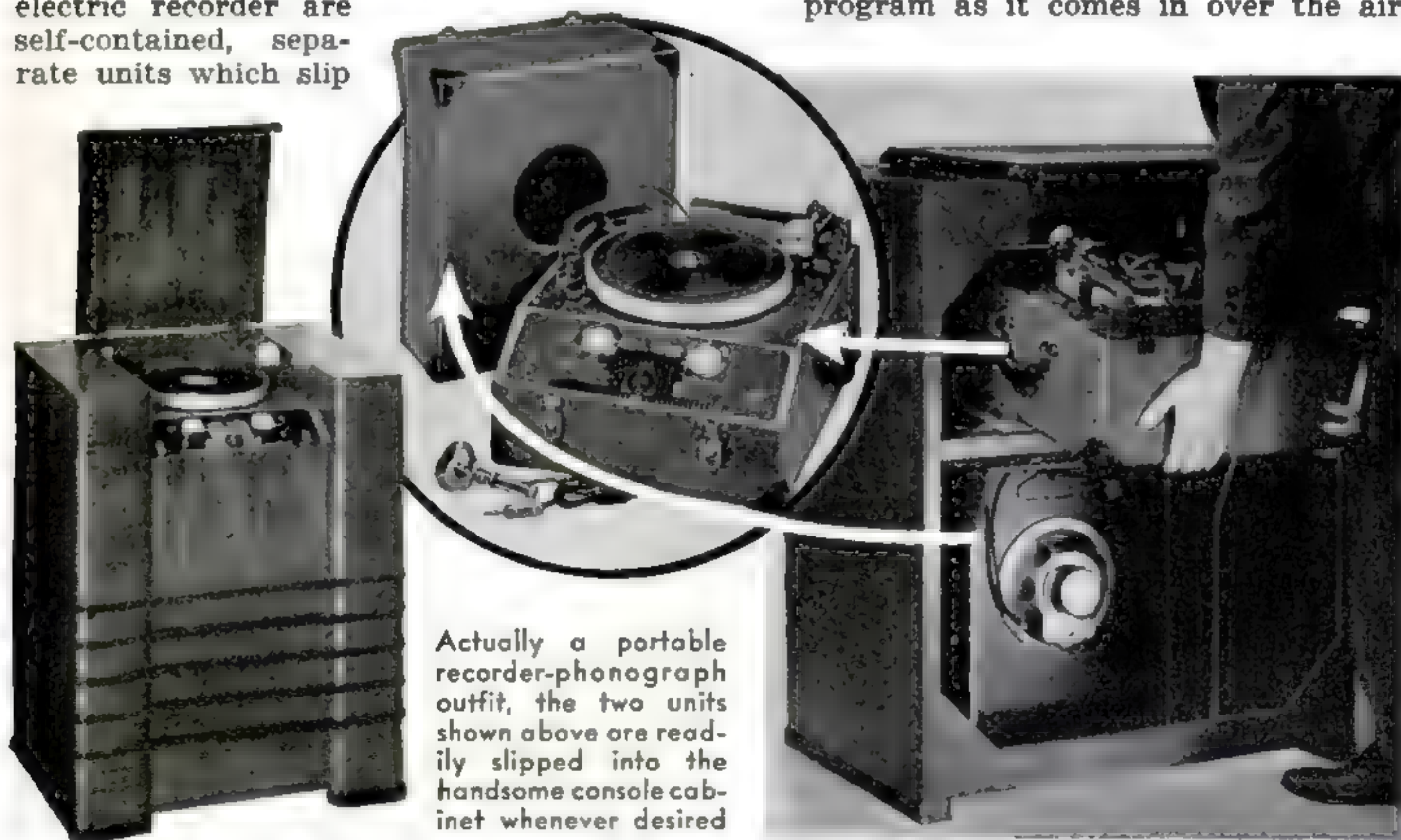
Attachable Loop Antenna

EASY to install by means of suction cups, a loop-antenna unit that can be quickly and permanently adjusted to match the requirements of either superheterodyne or tuned-radio-frequency receivers eliminates the need of an outside aerial and unsightly lead-in and ground connections. The unit is said to operate effectively even in congested city locations.

Portable Recorder Fits Inside Console

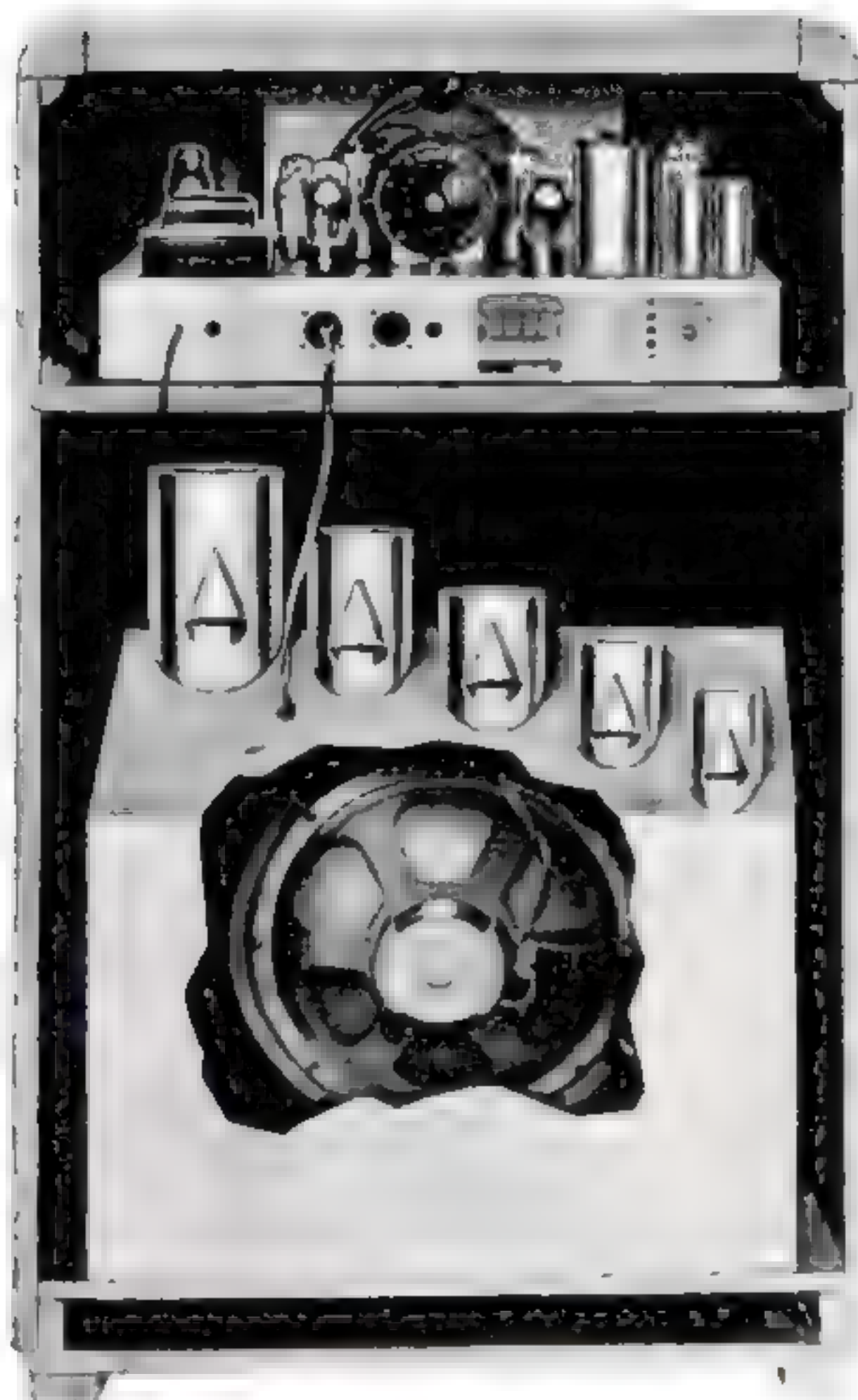
IT IS a matter of less than two minutes to convert a portable pick-up and recorder just marketed into a console-model radio phonograph for home use. As shown in the illustrations below, the speaker and the electric recorder are self-contained, separate units which slip

in or out of a console cabinet through its open back. The recorder unit contains a four-stage audio amplifier, complete recording and play-back equipment, and a high-fidelity radio tuner for transcribing a radio program as it comes in over the air.



Actually a portable recorder-phonograph outfit, the two units shown above are readily slipped into the handsome console cabinet whenever desired

WORLD OF RADIO



Note the five pipes like those in an organ that regulate the tone quality of the radio

"Organ-Pipe" Resonators Control Radio's Tone

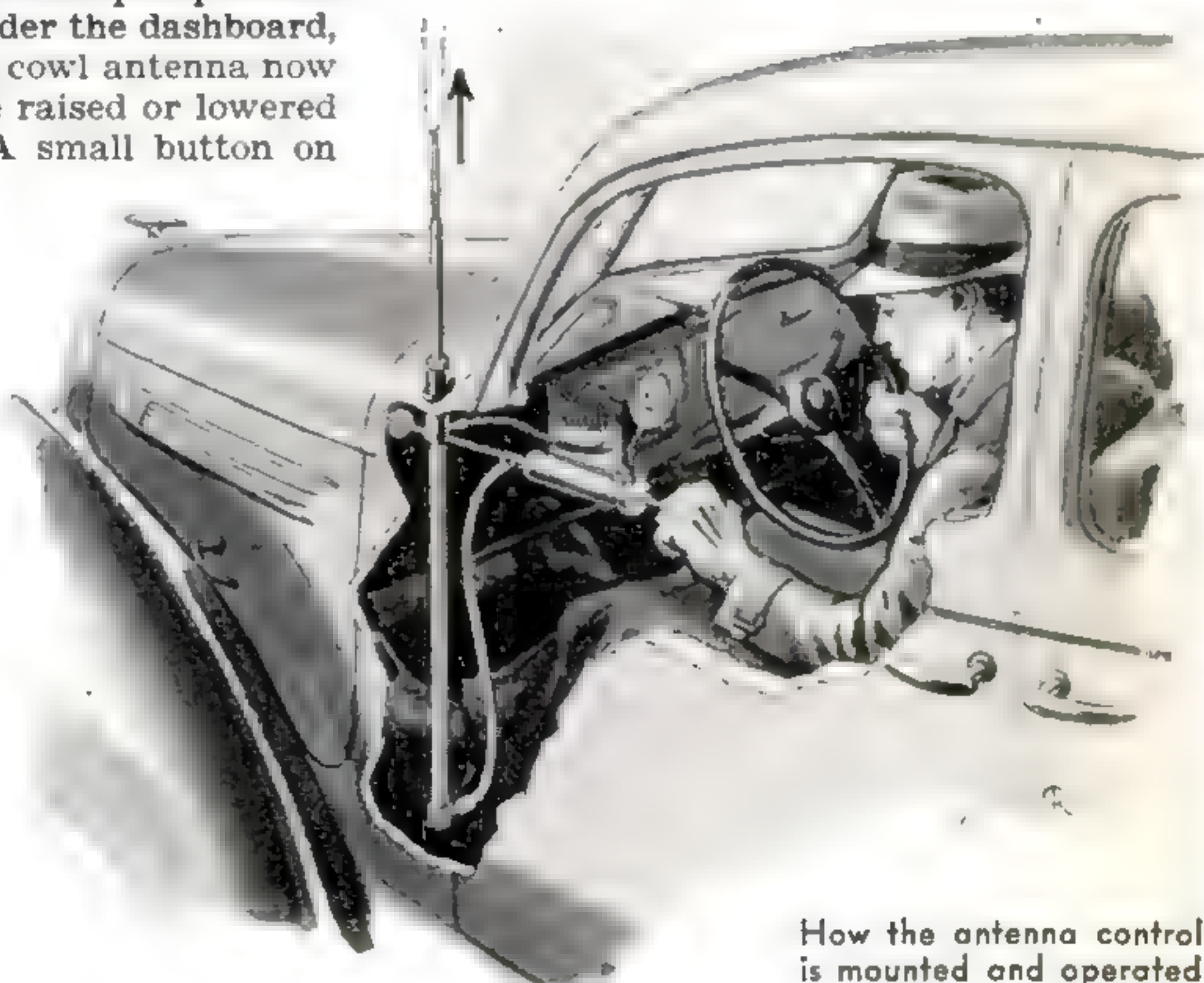
FEATURING a loudspeaker assembly fitted with five resonating pipes of graduated sizes like those used in organs, the new radio models of one manufacturer are said to do away with booming, barrellike tones, and false harmonies in radio reception, yielding the true, rich tones of instruments and voices. An "organ-key" control makes it possible to blend tones to the desired richness by pressing any one of the four keys regulating the organlike pipes. Fourteen distinct variations of tone are possible.

Unit Boosts Selectivity

INTERFERENCE between phone or code signals on the short-wave bands can be eliminated with a new inexpensive filter. In use, the filter is simply plugged into the earphone jack on the receiver and the earphones are plugged into the filter. By adjusting a single knob, the interfering signal can be suppressed and the desired signal received. The unit uses no tubes and comes complete in its own midget cabinet. It may be used with either a superheterodyne or a tuned radio-frequency receiver.

Dashboard Pump Raises Car's Antenna

OPERATED by a compact hand pump which is conveniently located under the dashboard, an automatic, telescoping cowl antenna now available for cars may be raised or lowered from the driver's seat. A small button on the plunger handle controls the direction of the antenna's movement from only three inches above the hood to a full length of forty-two inches when extended. Setting the button as the plunger is operated raises or lowers the antenna completely with only a few movements of the handle. Easy to install, the antenna is finished in durable chromium. Ceramic mounting brackets are provided for mechanical and electrical "soundproofing."



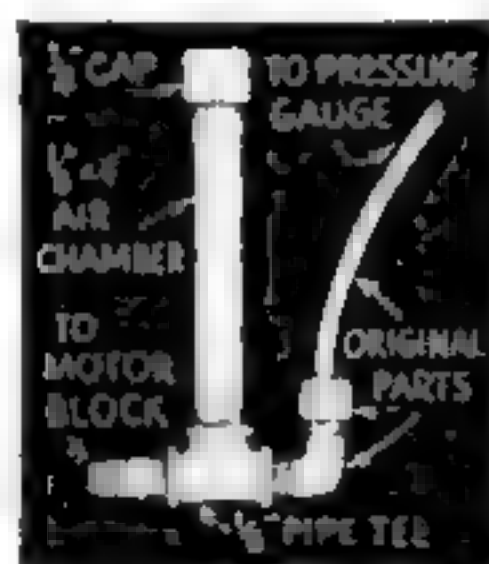
How the antenna control is mounted and operated

Useful Hints for Motorists

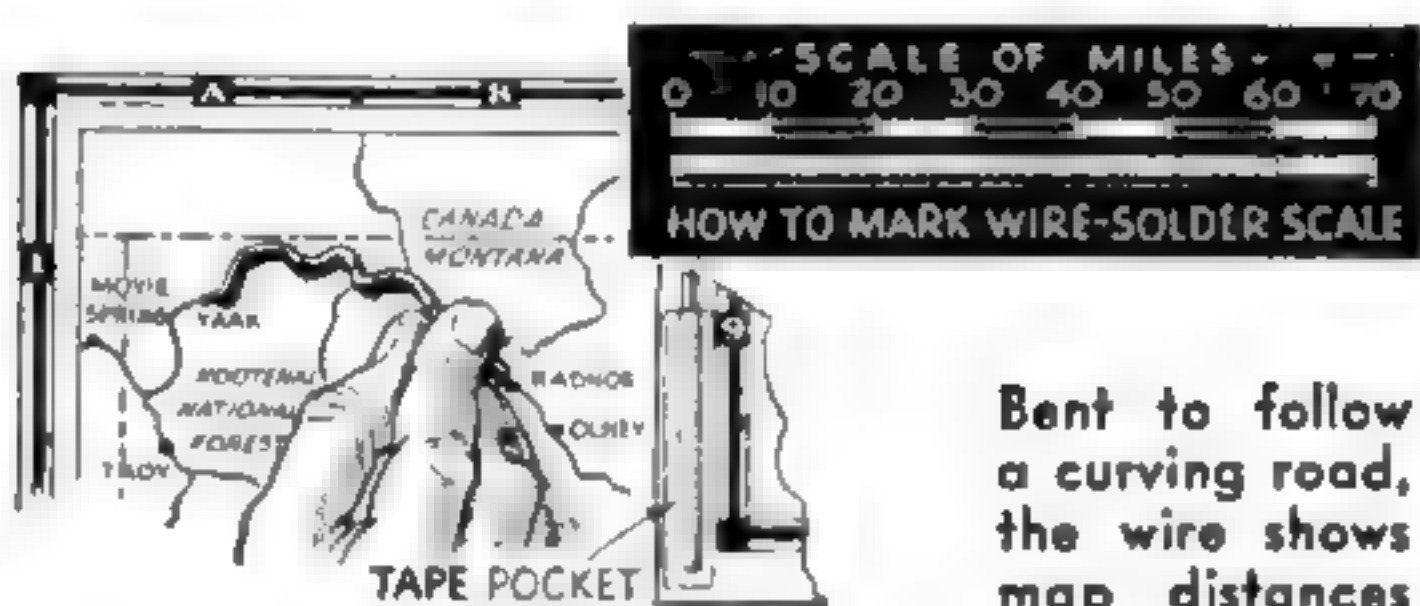
Air Chamber Cushions Oil-Line Knock

WHEN my new car knocked, I traced the noise to the oil line. I could even feel the pounding by touching the pipe leading to the oil-pressure gauge on the dashboard. The sound obviously was caused by the alternate stopping and releasing of the oil flow from the pump by the drilled crankshaft. I secured a $\frac{1}{8}$ " pipe tee, a $\frac{1}{8}$ " by 4" pipe, and a pipe cap, and assembled them as shown. I inserted the assembly into the motor block in place of the oil-line elbow, which I connected to the device. The upright pipe then provided an effective air chamber to cushion the pulsating oil and stop the knock.—E. G. G.

Installed in the oil-gaugeline, the device eliminates oil knock



Soft-Wire Scale Tells Map Distances

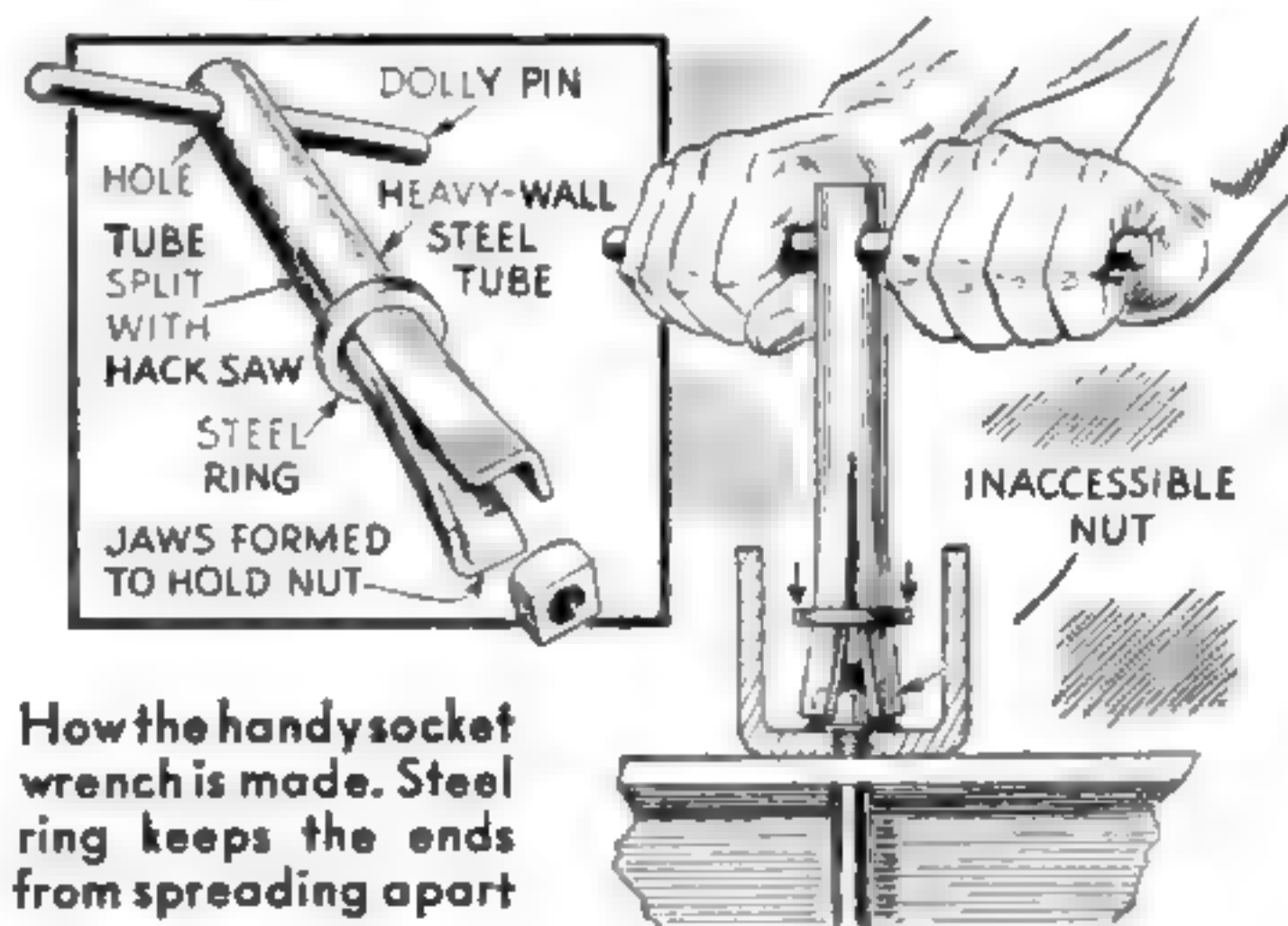


Bent to follow a curving road, the wire shows map distances

A SHORT piece of lead wire or wire solder, notched at intervals to conform to the mileage scale on a road map, helps you to estimate distances on trips. The soft metal wire bends so easily that you can shape it with your fingers to conform to the projected route on the map. The distance is then indicated by the notches. You can tape the wire to your map to keep it handy.

Homemade Socket Wrench Gets in Tight Places

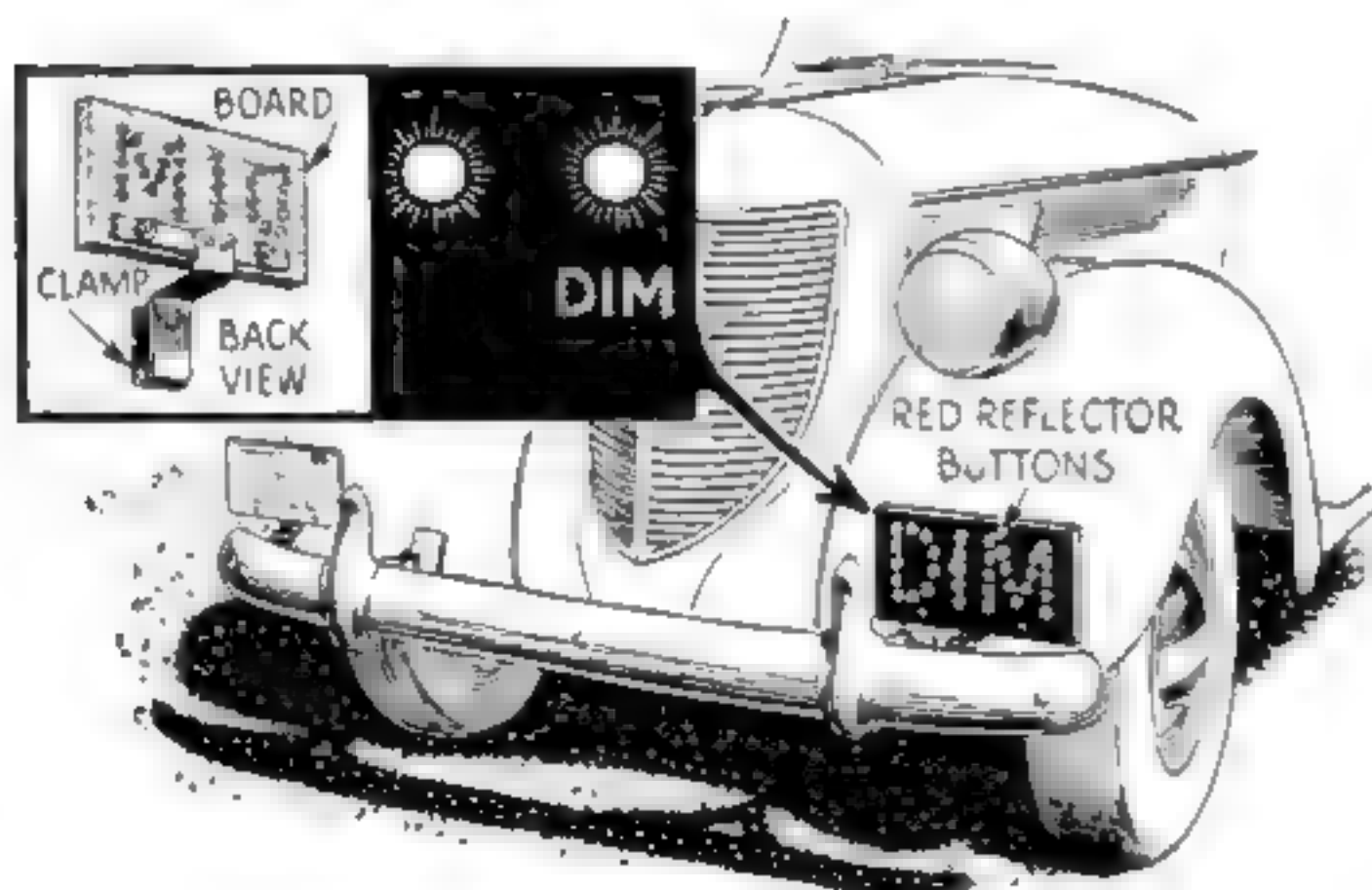
FOR getting at inaccessible place, a socket wrench can be made by hacking a slit half-way through the length of a piece of steel tubing, and drilling a hole in the solid end for a dolly pin. Add a steel washer as shown at the right, and form angles at the slotted end of the pipe. The washer will keep the wrench from spreading when severe pressure is applied to turn a nut in an out-of-the-way place.



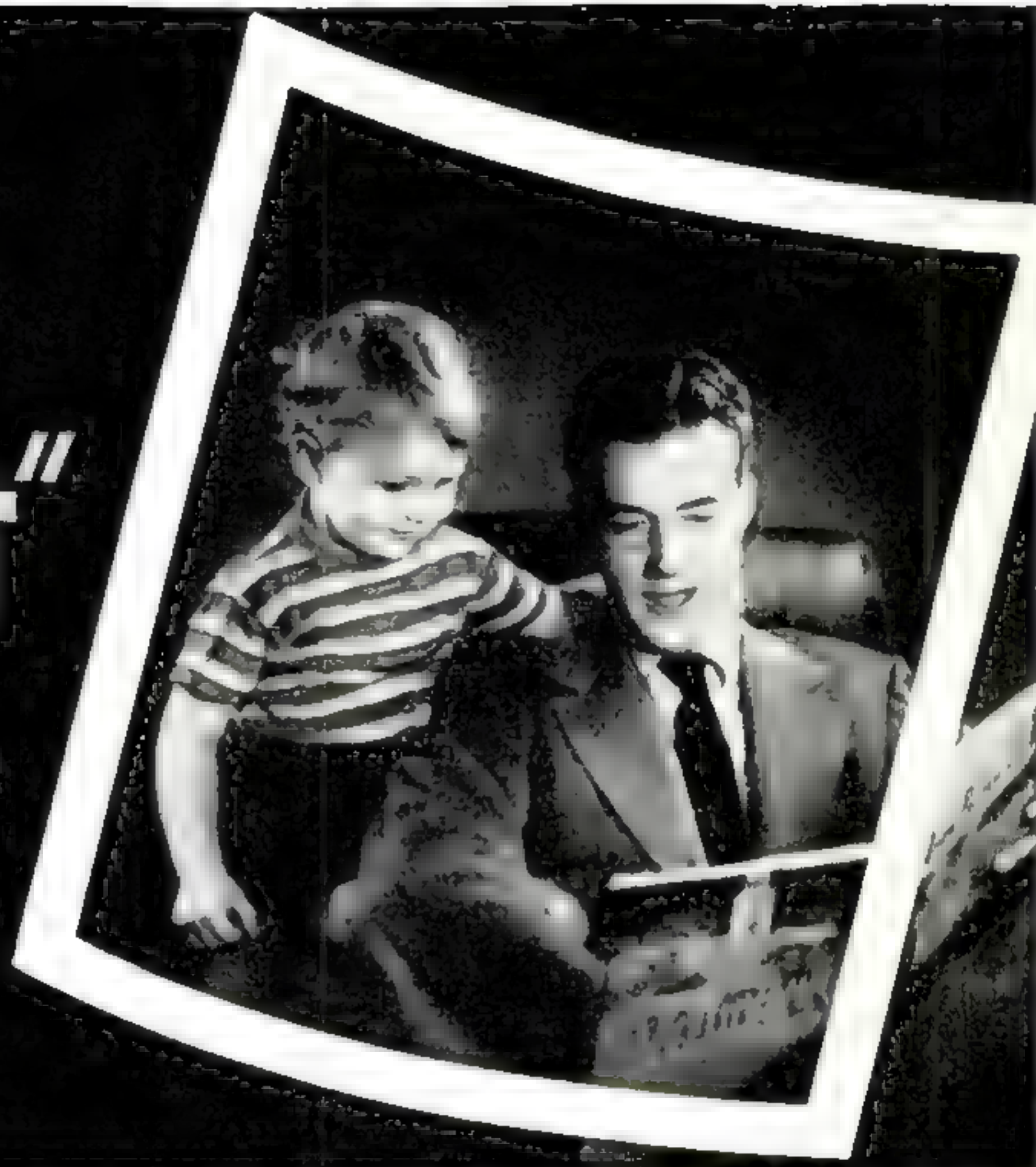
How the handy socket wrench is made. Steel ring keeps the ends from spreading apart

Reflector-Button DIM Sign Reminds the Other Fellow

RED reflector buttons mounted on a board to spell the word DIM, and fastened to the front bumper of your car, give an impressive but courteous hint to the driver of an approaching car at night to dim his headlights. Illuminated by the bright beams of the approaching lights themselves, the buttons appear to the approaching driver to go out as soon as he switches his lights to their depressed beams.—A. H. W.



Snap this "shot" tonight



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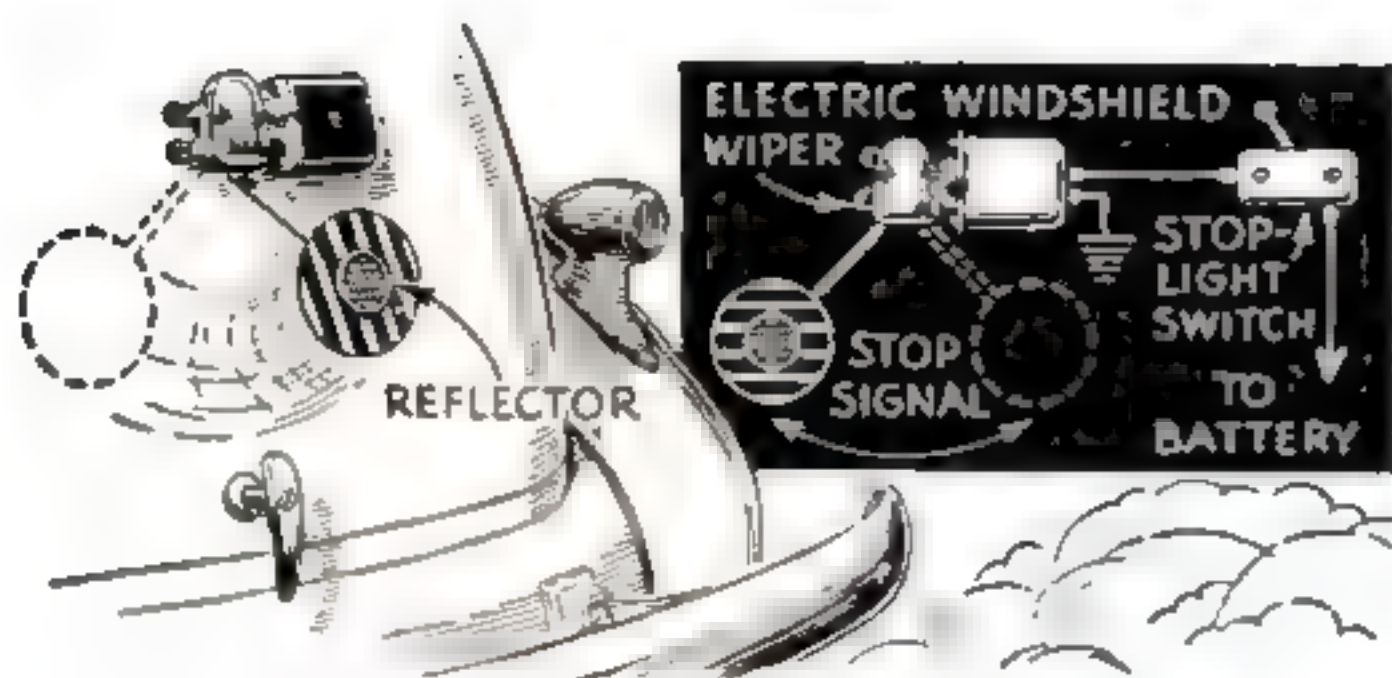


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Windshield Wiper Drives Wigwagging Stop Signal

A DISCARDED or second-hand electric windshield wiper in good condition can be readily converted into the power plant for driving a wigwagging automobile stop signal that commands instant attention. Mounted on the rear of a car, it is visible day or night for a considerable distance. To the wiper-blade arm, a metal disk four inches in diameter is soldered or bolted with brackets so that it is securely mounted. Paint the disk in alternate stripes of yellow and black, and attach to its center a red reflector button of the type used to mount license tags on their brackets. Bolt the wiper motor to the center of the luggage-compartment cover, or any desired point where it will be protected by the car's rear bumper from accidental damage. If the unit itself is found to be grounded when installed, connect the "live" terminal of the motor to the lead wire from the stop-light switch. When the brakes of the car are applied, the circuit is closed, and the wigwag swings rapidly back and forth like a pendulum, to signal cars behind you. If the unit is not grounded, it will be necessary to connect one of its terminals with the car chassis by means of a wire. Solder all connections.—J. H. G.

Asphalt Paint Protects Brake Line from Acid

OVERFILLING of automobile batteries mounted under the hood can be the cause of hydraulic-brake failure if the battery acid runs or drips down on the hydraulic line, resulting in corrosion and leakage. If any acid has been spilled in this way in your car, the first thing to do is to take it to a good mechanic who is capable of determining the possible damage. If the damage is only slight, wash the hydraulic line with soda solution along the length that has been exposed, and then dry it thoroughly. Then with a brush apply a coating of good asphalt paint to the pipe line. This will prevent damage if acid should accidentally be spilled on the line again.—R. P. O.



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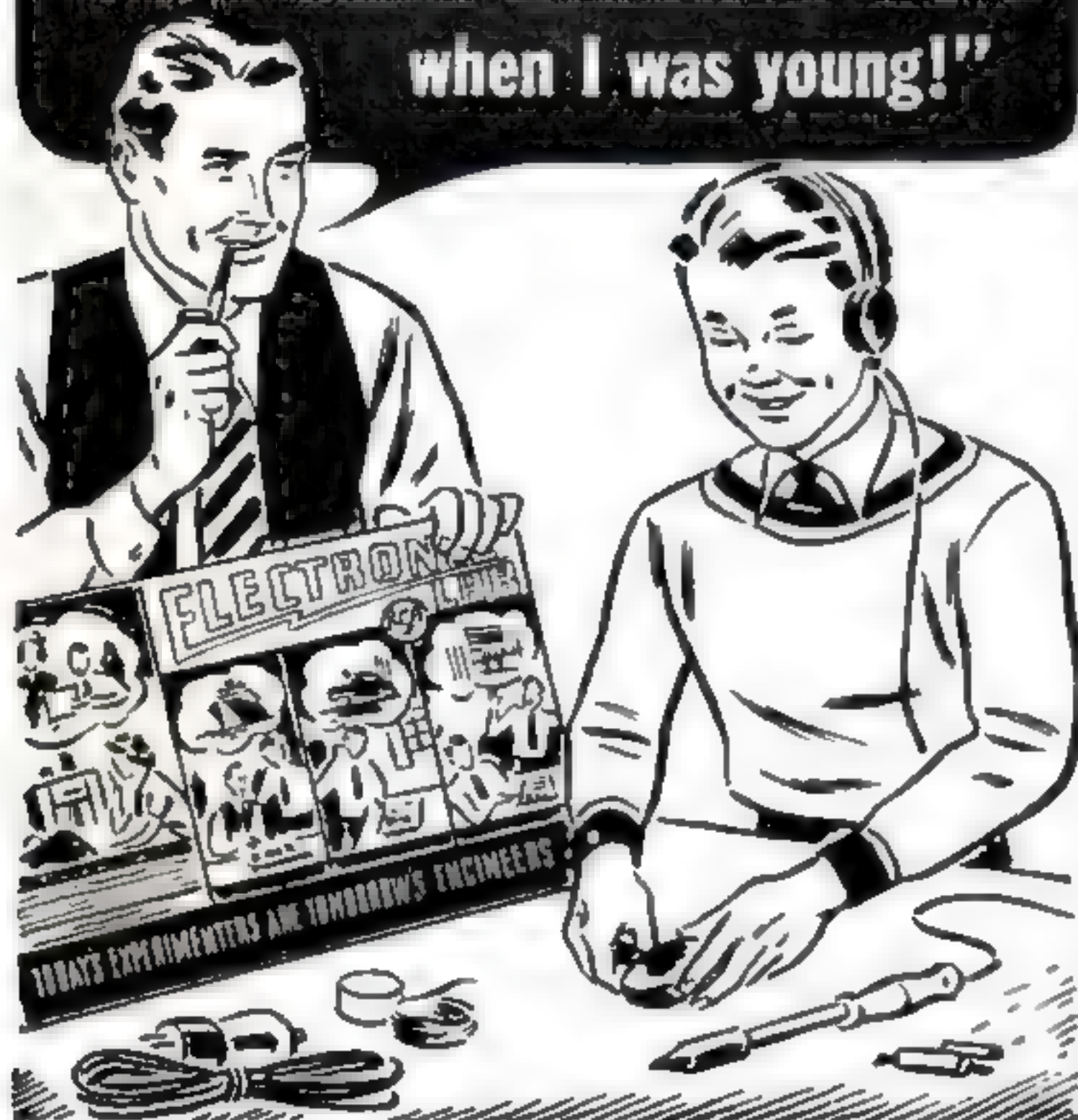
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Put on your own radio dramas with sound effects!

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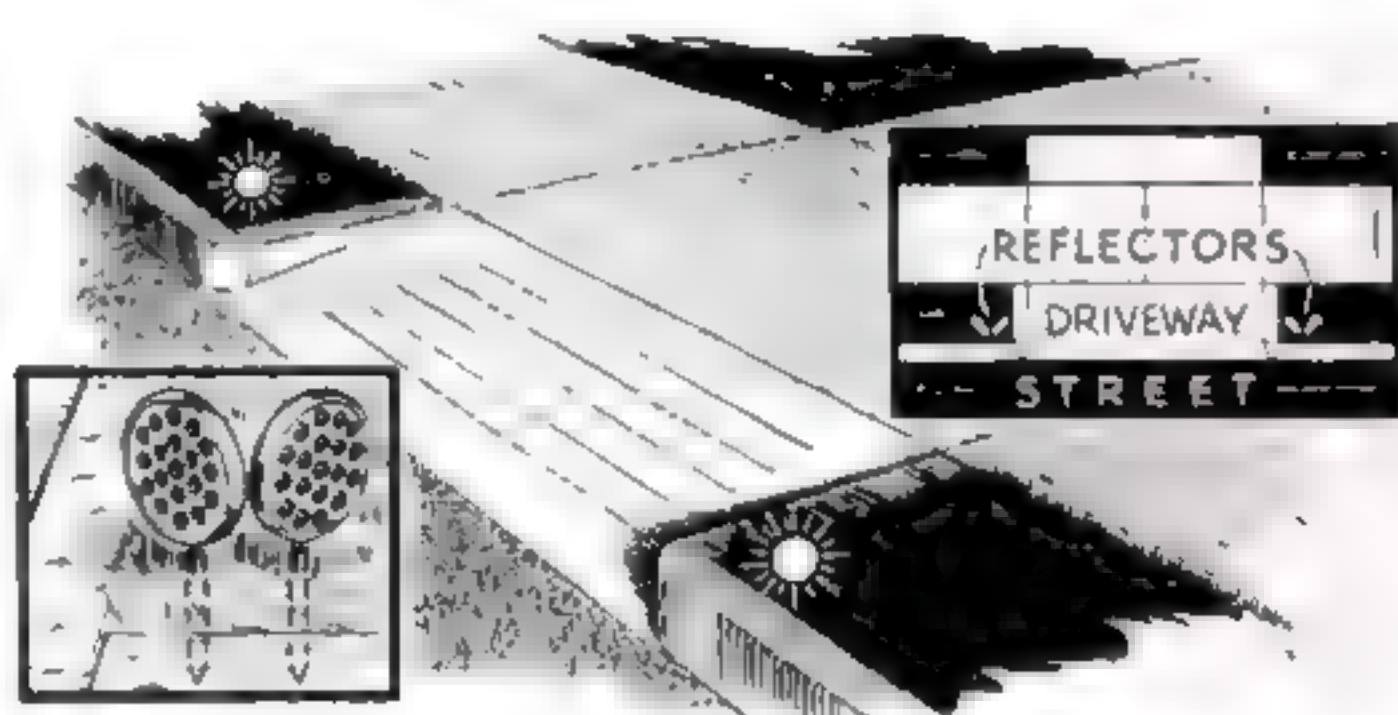


By-Products Division, RCA Manufacturing Company, Inc.
Camden, N. J. A Service of the Radio Corporation of America

Carpet over Garage Door Wipes Snow off Car Roof

It's not very good for a car to allow it to stand all night in a garage with a couple of inches of snow on its roof that may take hours to melt. I nailed up a piece of heavy carpet along the top of my garage doorway so that it hangs down far enough to act as a brush when the car is driven in, sweeping the snow off the back. In addition, I keep a big rag handy so that before closing the garage doors for the night I can wipe away any snow that still clings to the luggage-compartment cover.—O. B. N.

Reflectors in Ground Mark Driveway Entrance



IF YOUR driveway is located at an awkward bend in the road, or on a fairly dark street, so that it is not easy to find at night, the stunt illustrated in the drawings above will be found helpful as you and your friends drive up to your house after dark. At a bicycle or hardware store, you can obtain bicycle reflectors at a reasonable price. Reflectors two or three inches in diameter are best suited to the purpose. File or cut the metal brackets to a point and stick the points firmly into the ground a half foot or so from the street curb and about the same distance from the edge of the driveway on both sides of it. While one reflector can be used on each side of the drive, two on each side will show the width of the entrance as a driver approaches from either direction. As shown in the inset above, each reflector in a pair faces so that one is always visible from up or down the street.—R. M.

Handy License Holder

A GOOD place to carry the car owner's registration certificate is over the sun visor where it can be readily tucked into a small envelope. The envelope can be fastened securely in place by means of a few daubs of rubber cement.—B. J.

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...at home in
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Early Colonial pine chest, plan 308A, 25c

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GIFTS that you make in your home workshop are prized a great deal more than those bought at a store. Whether you want to construct furniture, radio sets, models, toys, or novelties, our blueprints will help you. The blueprints themselves make excellent gifts for men and boys who enjoy the home workshop hobby. Those marked with an asterisk (*) in the list below are particularly well suited for this purpose. If you do not see what you want in the list, send a stamped and self-addressed envelope for our complete blueprint catalogue.

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*Cabin Cruiser, 17' long, weighs 750 lb., for use with inboard or outboard motor from 2 to 10 h.p., 356-357-358-359-R	\$1.50
*Clipper Ship Model GREAT REPUBLIC, 31 1/2" hull, 272-273-274-R	1.25
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*Confederate Raider ALABAMA, 21 1/2" hull, 335-336-337-R	1.50
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Folding Duck Boat, 13' long, 170-R	.50
Magazine Rack and Wooden Wastebasket, 296A	.25
*Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R	1.00
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GIFTS FOR WOMEN

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Mirror Frame, 246A	.25
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Queen Anne Dressing Table, Stool, and Mirror, 295A	.75
Sewing Cabinets, Priscilla and Modern, 31	.25
Sewing Table, 1	.25
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Small Early Colonial Pine Chest, 308A	.25

(Continued on page 226)

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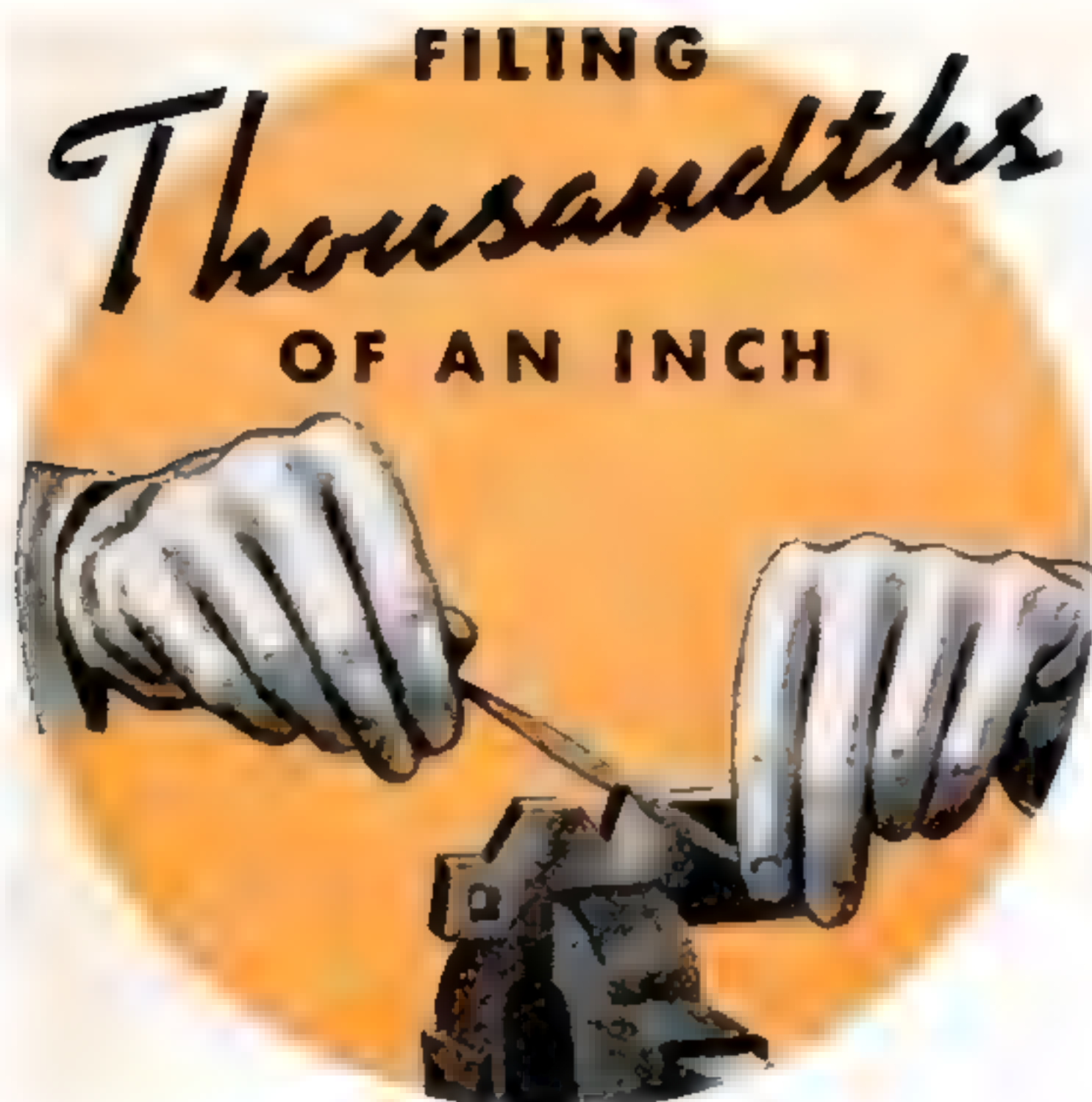
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(FLAT) 4" LONG,
NO. 2 CUT

A FILE FOR EVERY PURPOSE



Suggestions for Gifts

(Continued from page 224)

Telephone Table and Stool, 18 .....	.25
Tilt-top Table, 140 .....	.25
Upholstered Stool, 240A .....	.25

GIFTS FOR BOYS

*Barbary Pirate Galley, 20" hull, 44-45-R .....	.75
Bobsled, 9' 5" long, chassis of spruce and plywood, 362A .....	.50
*Brig MALEK ADHEL, 20" hull, frame-and-plank construction, 304-305-306-R	1.00
Clipper Ship in Bottle, 121-122 .....	.50
Cruiser U.S.S. INDIANAPOLIS, 12" hull, 216 .....	.25
H.M.S. BOUNTY, 8 1/2" hull, 254 .....	.25
Hunting Knife and Double-Decker Bed, 277A .....	.25
*Kayak (with sail, etc.), 192-193-194-R	1.00
Kite Reels, Ball-Bearing, 290A .....	.25
Liner QUEEN MARY, 10 1/4" long, 283 .....	.25
*Mississippi Steamboat BUCKEYE STATE, 19 1/2" long, 94-95-96-R	1.00
Motor Boat (20" model), 196 .....	.25
Racing Yacht, 20" sailing model, 48-R .....	.50
Tie Rack, Extension Book Rack, and Turned Box, 247A25
Treasure Chests, with metal bindings, 7825

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Card Table, Four-Leaf, 239A25
Colonial Design Doll's House, 7225
Doll's House Furniture, 7325
Floor Lamp, 243A .....	.25
Flowerpot Stand (38 1/2" high) and Novel Modern Lamp, 317A .....	.25
Knitting Bag with Wooden Frame, and Book Ends, 267A .....	.25
Magazine Rack, Ladder-Back, 250A .....	.25
MAYFLOWER, 24" model, 83-84-85-R	1.00
Sedan Chair (scale model), 123-12450
Sewing Kit, Pelican Design, 255A25
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Mexican Patio Furniture for Dolls, 354A-355A75
Projector for Photos and Pictures, 259A25
Six Simple Block Puzzles, 6525
Toy Lathe, Drill Press, Saw, and Jointer, 11325

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Amateur Short-Wave Receiver, 15525
Beginner's Battery Receiver, 365A25
Five-Tube Short-Wave Set (A.C. or D.C.), 22325
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One-Tube Receiver (battery operated), 10325

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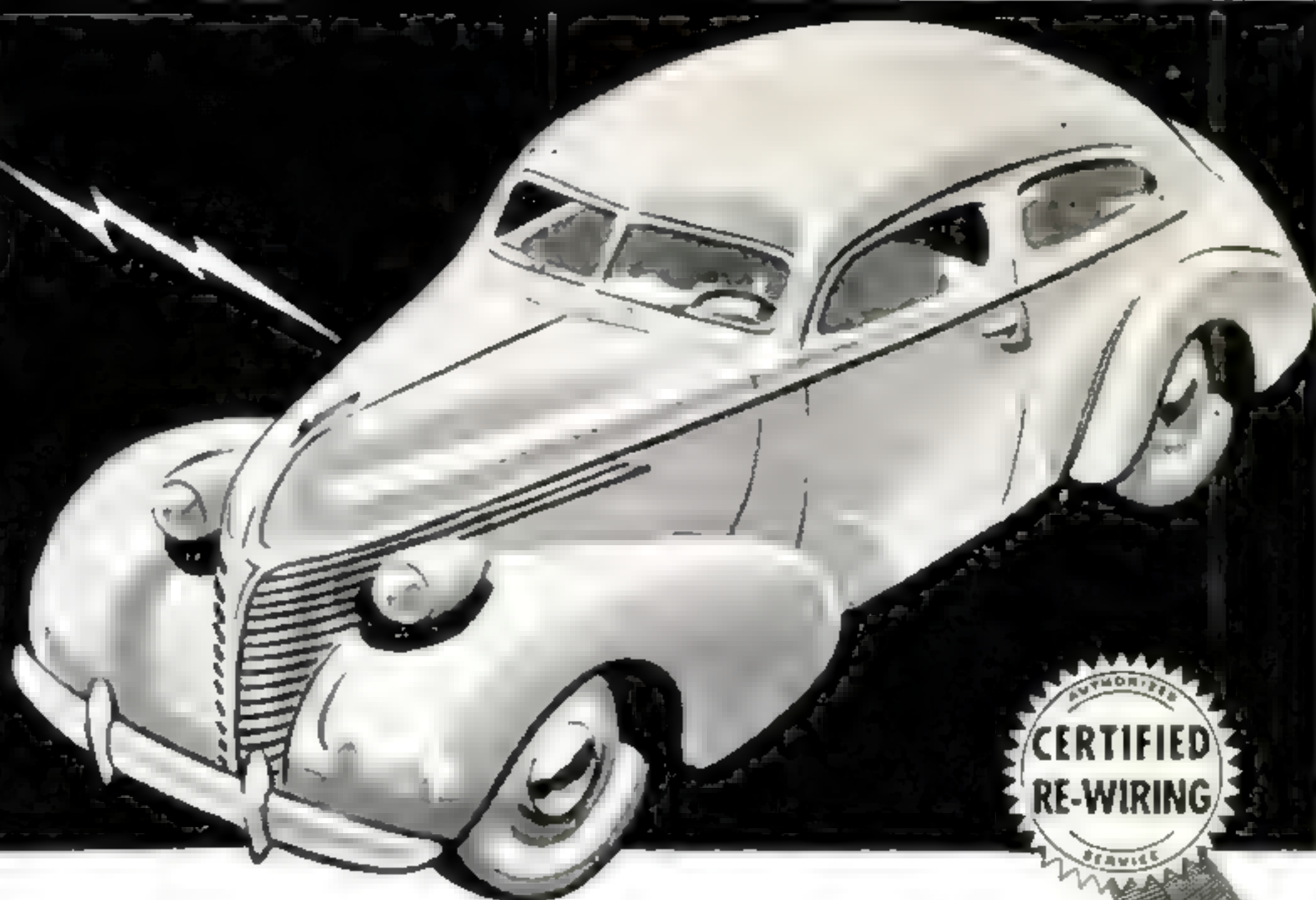
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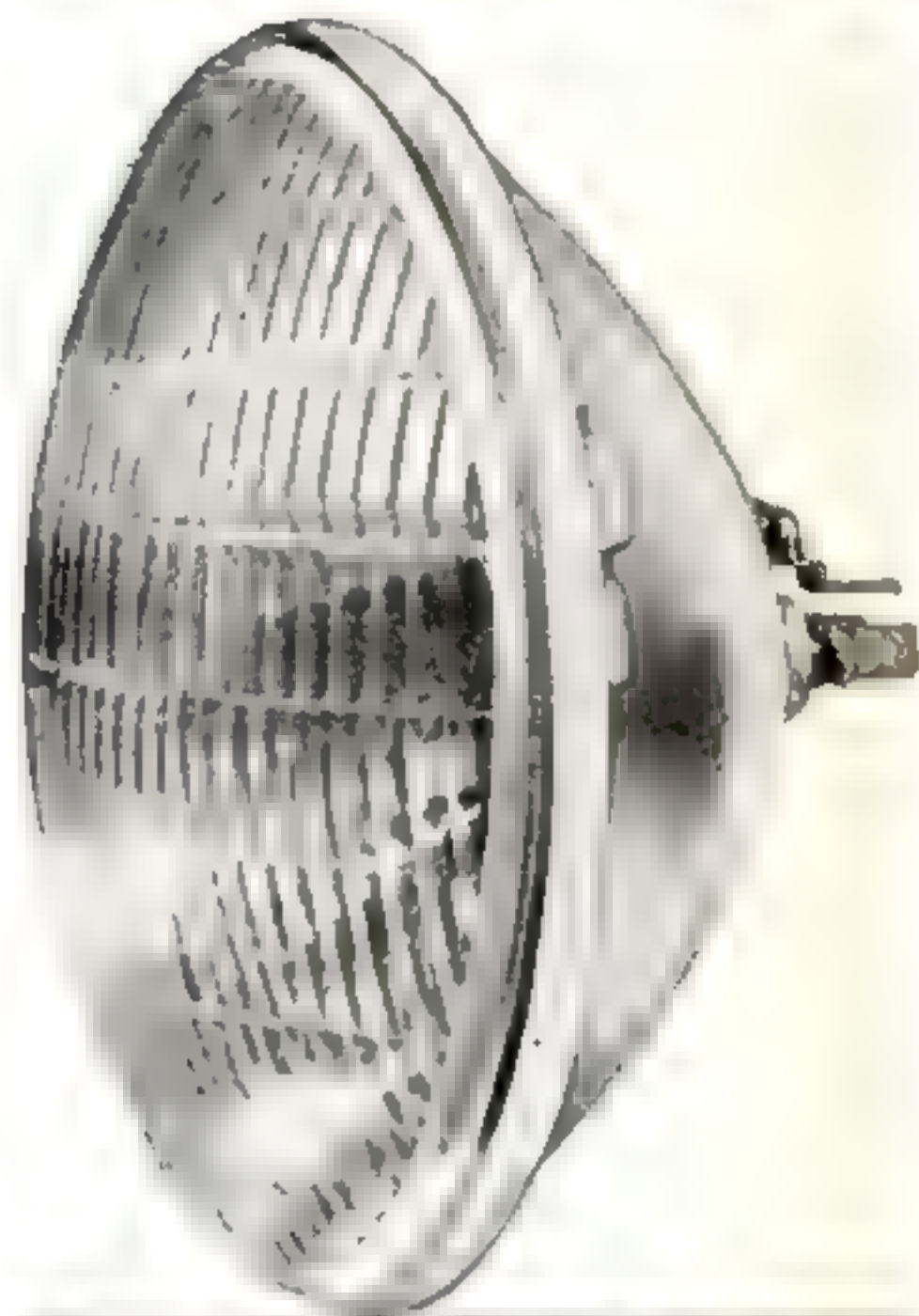
(Continued on page 230)

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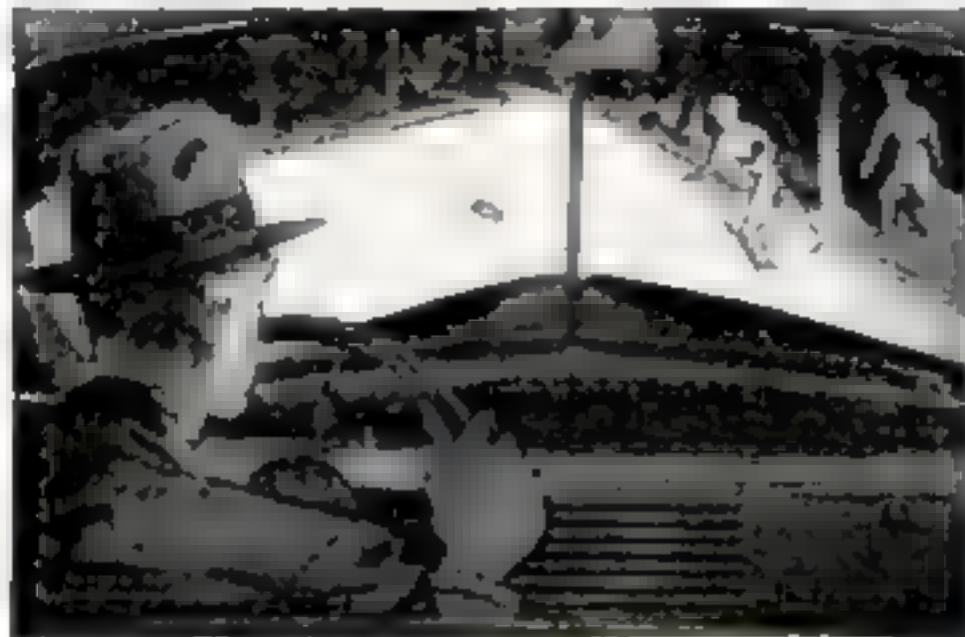
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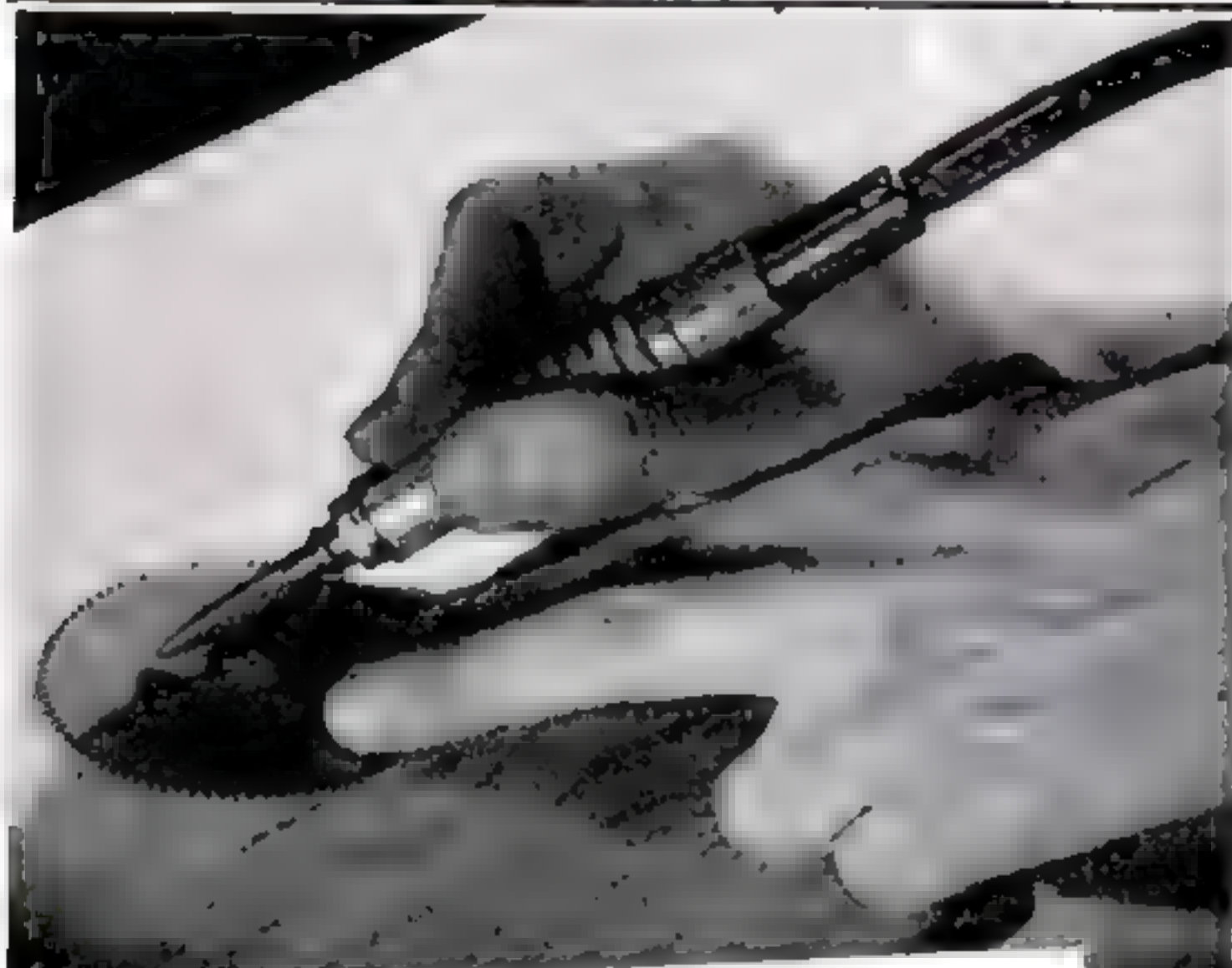


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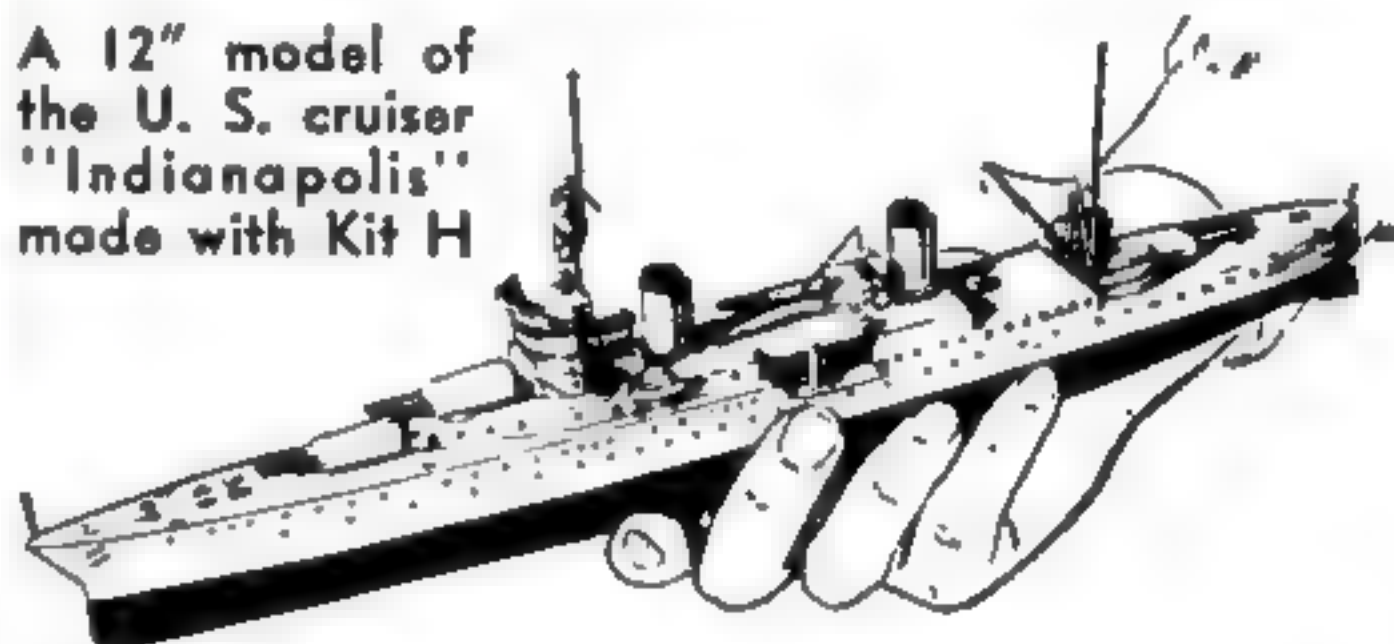
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Popular Science Monthly, Dept. 129A

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1939

Home

Workshop Index

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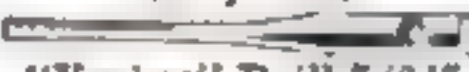
YANKEE HANDYMAN

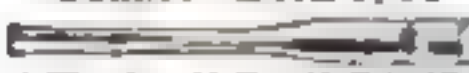
TOOLS FOR THE HOBBYIST

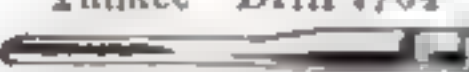
GET "Handyman" tools for your workshop. New speed, greater ease—driving screws, boring holes! "Yankee" Handyman Screw Driver No. 133H—with *Spring in Handle*, \$1.25, is ideal drill. No. 33H, without spring in handle, only \$1.00.


To bore holes for screws, ream, etc., with Handyman No. 133H or No. 33H, buy these "Yankee" Accessories. They fit Driver in place of blade. Sold separately, as below or in Pak:


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Big News! Genuine "Yankee" quality now yours in a small screw driver for **Twenty-five Cents!** "It Ratchets!" Gets the best of tiny screws . . . saves time, temper. Simply turn to and fro. Adjust ratchet to drive or draw screw.

IT RATCHETS

YANKEE
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25

Length, 4 1/16".

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HERE'S the way many car owners do it every year! They put in a couple of quarts of Du Pont "Zerone" early in the season for protection against rusting and the sudden cold snaps they know will come.

When winter gets down to real business, they add enough "Zerone" to protect them to lower temperatures. A total of six quarts, put in as needed, can protect a car with an average size cooling system for the entire winter. And six quarts of "Zerone" cost only \$1.50! Just one gallon protects an average size cooling system (15 quarts) to 1°. Five quarts would protect it to -12°; six quarts to -27°!

You may need a little more or less, depending on the condition and capacity of your car radiator and the severity of winter in your neighborhood. But the unusual efficiency of Du Pont "Zerone" will save you real money.

"Zerone" in a clean cooling system prevents rust and corrosion, which reduce operating efficiency. It gives better dissipation of engine heat, avoids power losses. Protect your car with "Zerone" this very day! It's only \$1.00 a gallon, 25¢ a quart.



DU PONT

ZERONE

ANTI-RUST ANTI-FREEZE

*Old
 Bill
 Says*



A GOOD way to clean a T-slot is to cut a piece of felt so that it is a snug fit in the bottom section of the slot and leave on a tongue that can be pulled along with pliers.

New V-belts intended for multiple operation must necessarily be matched for equal drive or the set has no beneficial properties.

An economical keyway may be produced in a gear, a cutter, or a similar blank by fitting a soft steel plug to the bore and drilling a hole on the intersecting line. The correct drill will cut a full radius that can quickly be filed to keyway requirements.

Speaking of floating reamers, a 0.005" difference between shank diameter and bore of float is sufficient unless crisscross wear exists between spindle and tailstock or turret.

An improved finish now being given grinding-machine spindles permits using kerosene as a lubricant. The conventional film clearance is greatly reduced, and the increase in lubricant temperature over room temperature is only ten percent as compared to sixty-five or seventy percent when spindle oil is used.

Do not attempt to lap separately two flat surfaces and expect to get parallelism. The parts must be lapped between two lapping plates that have previously been lapped into each other.

If a so-called cylindrical grinding gauge is made a part of a twenty-year-old grinder, the latter may usually be returned to use in a machine shop and regarded at least as a semi-modern machine tool.

An H-beam serves as a good V-block when lining up pipe so that several pieces may be welded together. For smaller pipe, use angle iron.

Some machine tools of recent design have as many as six motors to operate the various components. This is proof that motorizing is cheaper than gears, sprockets, universal joints, shafts, and whatnots.

An electrode holder used in electric welding will last longer and work more efficiently if brushed with machine oil at the start of each day. For heavy usage, apply the oil twice a day.

Powerful New DELTA SHAPER

It's here at last—and arousing tremendous interest among power tool users everywhere. This new Delta unit offered at a surprisingly low price is a basically improved shaper—a powerful, smooth-running accurate tool that gives you heavier, faster cuts than the ordinary light shaper. It will shape, form or mould any form of work from the smallest mouldings to heavy production work.

Many Special Advantages

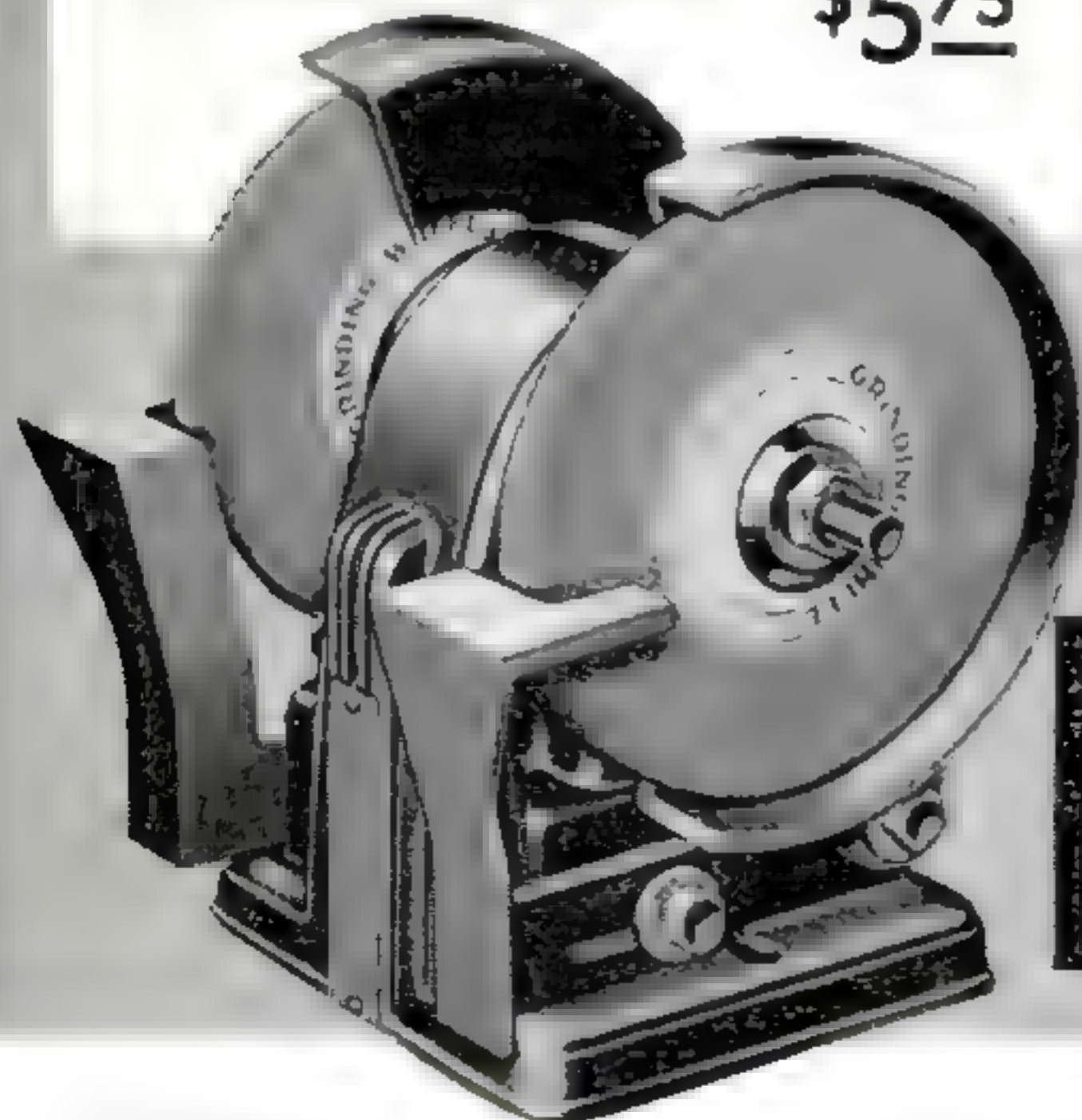
Some of its new features are: 1. *Large Husky Spindle*; 2. *Exceptionally Big Table*; 3. *Long Spindle and Spindle Travel*; 4. *Large Sealed-for-life Bearings*; 5. *Powerful V-Belt Drive*; 6. *Interchangeable Spindles*; 7. *Fully Adjustable Fence*; 8. *Strong, Welded Cabinet*. Every man interested in power tools should get the full details on this remarkable machine.



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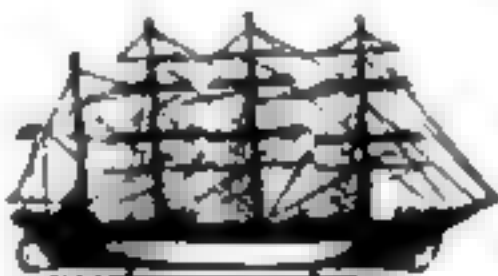


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Write Dept. 5, Junior Motors Corp., 2545 N. Broad St., Phila., Pa.

Gas Turbines

(Continued from page 81)

generator, directly coupled or geared to the main shaft.

For starting, a relatively small electric motor sets the whole machine turning at about a fourth of its normal rate. Then the oil burner is cut in, and the roaring turbine picks up speed under its own power. Automatic controls keep the top speed constant. If the turbine starts to race too fast, for example, a governor cuts down the oil supply, and a safety valve by-passes overheated gas around the turbine blades.

Gas turbines of this design operate most economically in sizes of from 3,000 to 60,000 horsepower. Therefore they will offer a challenge particularly to heavy Diesel motors. In mechanical efficiency, the Diesel has a little the best of it at present. But this is largely offset by the important advantage that the gas turbine can burn practically any gaseous or liquid fuel—including the lowest grades of fuel oil, which cost half as much as those required for Diesels. Eventually, by increasing the temperature at which the gas turbine can safely operate, engineers hope to boost its efficiency to a point where it will lead on every count.

Earlier inventors, starting with one who tried out a hot-air turbine in 1900, had made little progress toward a practical gas turbine when Brown Boveri engineers tackled the problem some years ago. Two key advances, one a contribution of their own, account for their success where others failed.

Turbine materials that would stand up under a 1,000-degree temperature were the first requirement. Unknown until recently, they became available with the modern development of steam turbines working at extremely high temperatures.

The other prime need was to develop a highly efficient air compressor for the gas turbine. To avoid mistakes made by others, when aerodynamical knowledge was more scanty than at present, the Swiss experimenters went first to the aviation industry and studied the latest researches on airplane design. Then they translated their findings into curved blades for a radical, superefficient blower of turbine form. With the second major difficulty conquered, the rest was simply a matter of good, sound engineering, and the gas turbine was born.

First installations were of a hybrid sort. Refiners of petroleum saw striking possibilities for the gas turbine in the Houdry oil-cracking process, which requires compressed air, and delivers combustible gas as

(Continued on page 238)

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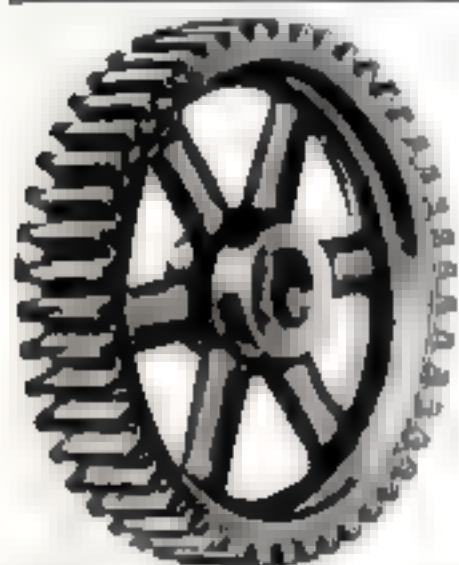
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Gas Turbines

(Continued from page 236)

a by-product. So a Marcus Hook, Pa., refinery installed a gas turbine, fed the waste gas into it for fuel, used its compressed air in the chemical process, and was able to hook on a generator for good measure! Other oil companies followed suit. The first of these gas-turbine units has been running successfully since December, 1936, and eleven others, ranging from 1,800 to 7,000 horsepower, have been installed or are under construction at this writing.

From all these, the new 20,000-horsepower gas turbine for the Swiss plant at Neuchâtel is distinguished by the fact that it is the first intended exclusively for generating power. At last the gas turbine has come into its own, and seemingly limitless possibilities lie ahead of it.

Check Your Personality

DID you answer the thirty questions on pages 76 and 77? Check your answers with the lists below. If you have answered no more than nine in either group properly, your adjustment is inferior and you need to give special attention to these problems. If you got nine to twelve right in either group, you are average. Thirteen to fifteen marks you as unusually well adjusted. To find your average rating for both parts of the test, take the total number of proper answers and divide by two.

Self-Adjustment

- | | | | | |
|--------|--------|--------|---------|--------|
| 1. Yes | 4. Yes | 7. No | 10. No | 13. No |
| 2. No | 5. Yes | 8. Yes | 11. Yes | 14. No |
| 3. No | 6. No | 9. Yes | 12. No | 15. No |

Social Adjustment

- | | | | | |
|--------|--------|--------|---------|---------|
| 1. No | 4. Yes | 7. No | 10. No | 13. Yes |
| 2. Yes | 5. No | 8. No | 11. No | 14. No |
| 3. Yes | 6. Yes | 9. Yes | 12. Yes | 15. No |

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To make ethylene glycol adaptable to cooling system service required years of exhaustive research by National Carbon Company, Inc. It required millions of the most murderous miles of test driving an anti-freeze can undergo.

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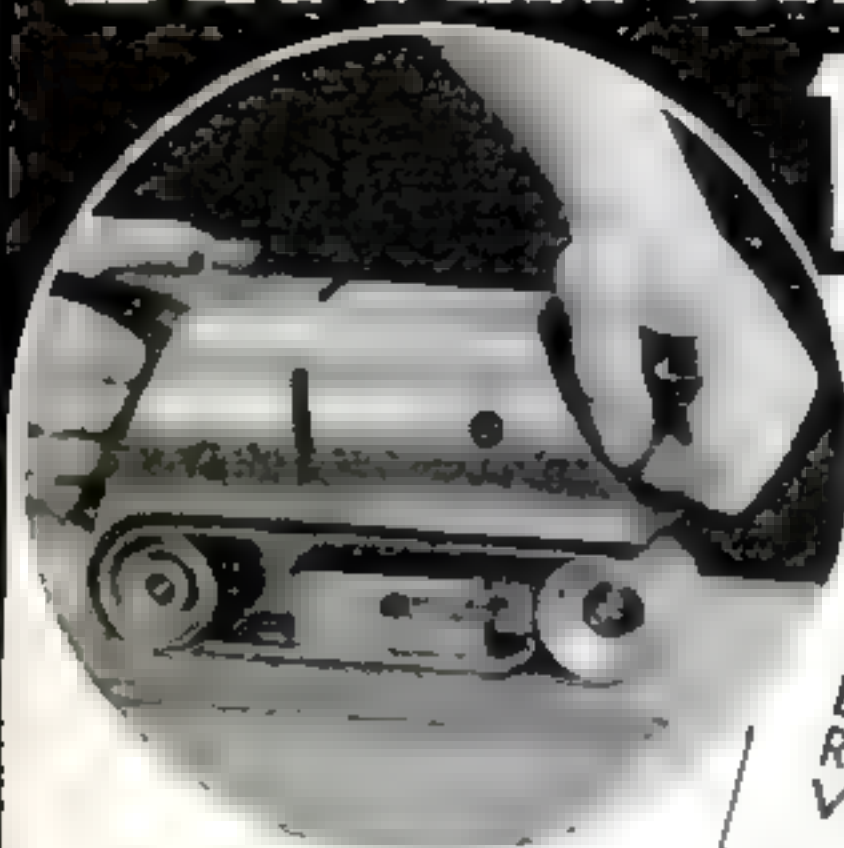


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Forty Years of the Automobile

(Continued from page 63)

marks that followed in the next decade, however, show the distance it had to cover, and spotlight the tremendous progress made. For example:

1900. The steering wheel was introduced and engines came out from under the seat and moved up front. The first automobile ambulance was built. A Yonkers, N. Y., car owner was overcome in his combination barn and garage by a mysterious gas.

1901. The speedometer made its appearance. Connecticut imposed the first traffic laws for motor cars.

1902. The Locomobile introduced the first electric generator for car storage batteries. Tom Shevlin, famous Yale football player, was fined ten dollars for exceeding ten miles an hour in his car.

1903. An Oldsmobile "Pirate" set a speed record of five miles in six and a half minutes. The Mack Company made the first bus. A Packard crossed the continent in sixty-one days.

1904. Windshields appeared. The Pope-Hartford company was criticized by the automobile industry for setting a bad precedent by including head and tail lights in the original price of its cars. For years, lamps, mud guards, and tops were extras.

1905. An automobile was sold on the installment plan. Tire chains were introduced. St. Louis, Mo., reported the first stolen car.

So it went, year after year. In 1909, Oldsmobile made the first closed car, and in 1911 Cadillac brought out the first automobile equipped with the electric self-starter.

The great American sport of touring was gaining ground, although a trip of fifty miles or more was not yet to be taken lightly. For dust was so thick, that in spite of veils, goggles, and linen dusters, every trip necessarily ended in a bath. And even as late as 1920, the editor of an automobile guidebook recommended thirty-four items that should be taken along on any extended motor tour for emergency use.

That's a far cry from today, when millions of streamline, trouble-free American cars eat up billions of miles on broad concrete highways, and when the automotive industry is second only to iron and steel as the top industry of the nation. Yet few people believe that the automobile has now reached its full maturity. We smile at the cars of 1900, but we confidently expect 1980 buyers to laugh out loud at the cars that satisfied the pioneers back in 1940.



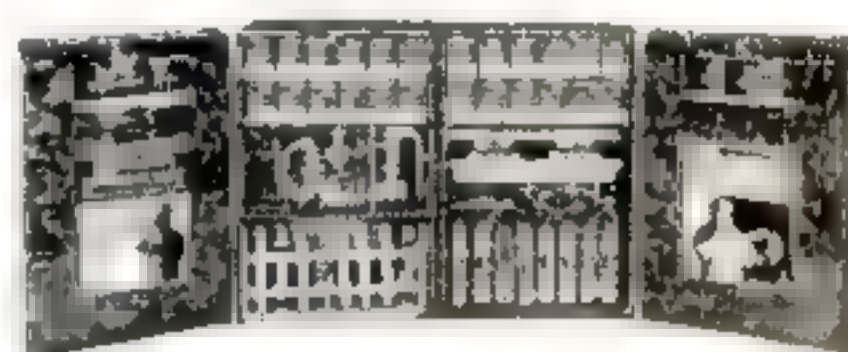
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(SEE PAGES 220 and 239)

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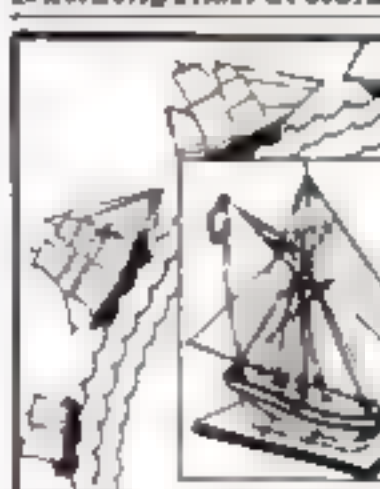


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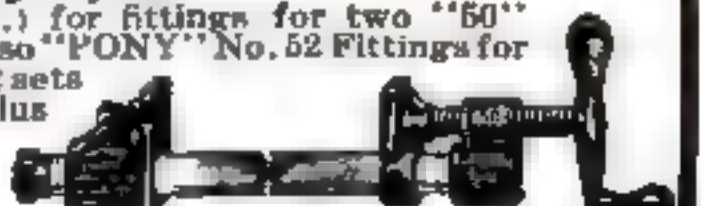


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Gus Takes a Holiday

(Continued from page 156)

put bubbles into the lines. I'm going to get washed up. When Dr. Marvin comes in, you tell him about it."

Ten minutes later, Gus was cleaned up again and getting into his car, when an easy-to-look-at young woman drove a snappy little roadster up to the shop door.

"You're Mr. Wilson, aren't you?" she said. "My name is Ruth Smith—I'm visiting Peggy Simpson. I'm having an awful time with my car, and I've just got to drive to Hartford this afternoon."

"Well, now, Miss Smith," Gus said, "I'd certainly like to be able to help you—especially as you're a friend of Peggy's. But, honestly, I can't do anything with your car today. I've been trying to get away from here ever since eight o'clock this morning."

"Oh, that's terrible!" Miss Smith said, in a tone which made Gus feel like a heartless brute. "I drove down to the city this morning, and it has taken me over two hours to get back here. Every few miles my car just stops. I've had it in three garages."

"Well," Gus weakened, "I'll take a quick look. But I've got to hurry. Let's see. Suppose we take a little ride and test her out." Miss Smith moved over so that he could drive. He drove up the road for a mile. The car was running perfectly. Then he turned back. They came to a place where the road had been torn up, and Gus slowed down going over the rough spot. When he stepped on the accelerator pedal the engine suddenly went dead.

"There!" Miss Smith said triumphantly. "That's just what it did all morning."

Gus got out, raised the hood, and made an examination that disclosed nothing. Leaving the hood raised, he stretched his bulky length on the fender, grasping the nearest radiator brace rod to steady himself. "Now you drive along slow," he directed, "and I'll see what I can see."

They came to another rough spot on the road. The driver slowed down to take the bumps, then stepped on the gas again. Once more the engine went dead.

"Hold on, I've got it," called out Gus. "Well I'll be . . . !"

The car came to a halt at the side of the road. Gus climbed back to earth. "I've heard of fuses blowing out, and tires blowing out, but here's a 'blow-out' that's new to me. Know anything about cars, Miss Smith?"

"A little."

"Well, look." She got out and obeyed.

(Continued on page 245)



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Gus Takes a Holiday

(Continued from page 243)

"See this wire? That's the lead to the coil there that makes the spark in your spark plugs. That wire is an old one that the insulation has rotted on. It's much too long, too. See where it's cracked here, near the coil terminal? The wire's broken under that crack. When you hit those bumps back there, they made the whole wire bend downward, and the wind from the fan held it down. That broke the connection, shutting off the motor. When the car stopped, the fan stopped blowing on the wire. It sprang back up like it is now restoring the connection. Let's get going, and I'll be on my way to the Fair!"

"Oh, that will be wonderful!" Miss Smith said. "Be sure to see—"

She talked about the Fair until they got back to the garage. When they drove up, Gus was surprised to see that Joe Clark and a state trooper he didn't know were standing near his car, both looking serious. "Here he is now!" Joe said.

"You're wanted down at the substation, Mr. Wilson," the trooper said. "Right away! Let's go!" He got on his motor cycle. "Follow me—and keep close!"

"What the heck's all this about?" Gus demanded.

"Orders!" said the trooper. "Hurry up!"

"Harry!" Gus called. Harry came out. "See this wire leading to the ignition coil. It's broken. Fix it up for this young lady. Now, Joe..."

The engine of the trooper's motor cycle roared.

"You'd better go, Gus," Joe said. "I guess it's something important."

Gus got into his car, and followed the trooper. As soon as they were on the road, his escort speeded up to forty-five and opened his siren all the way. They sped through the center of town, then down the road to the State Police substation.

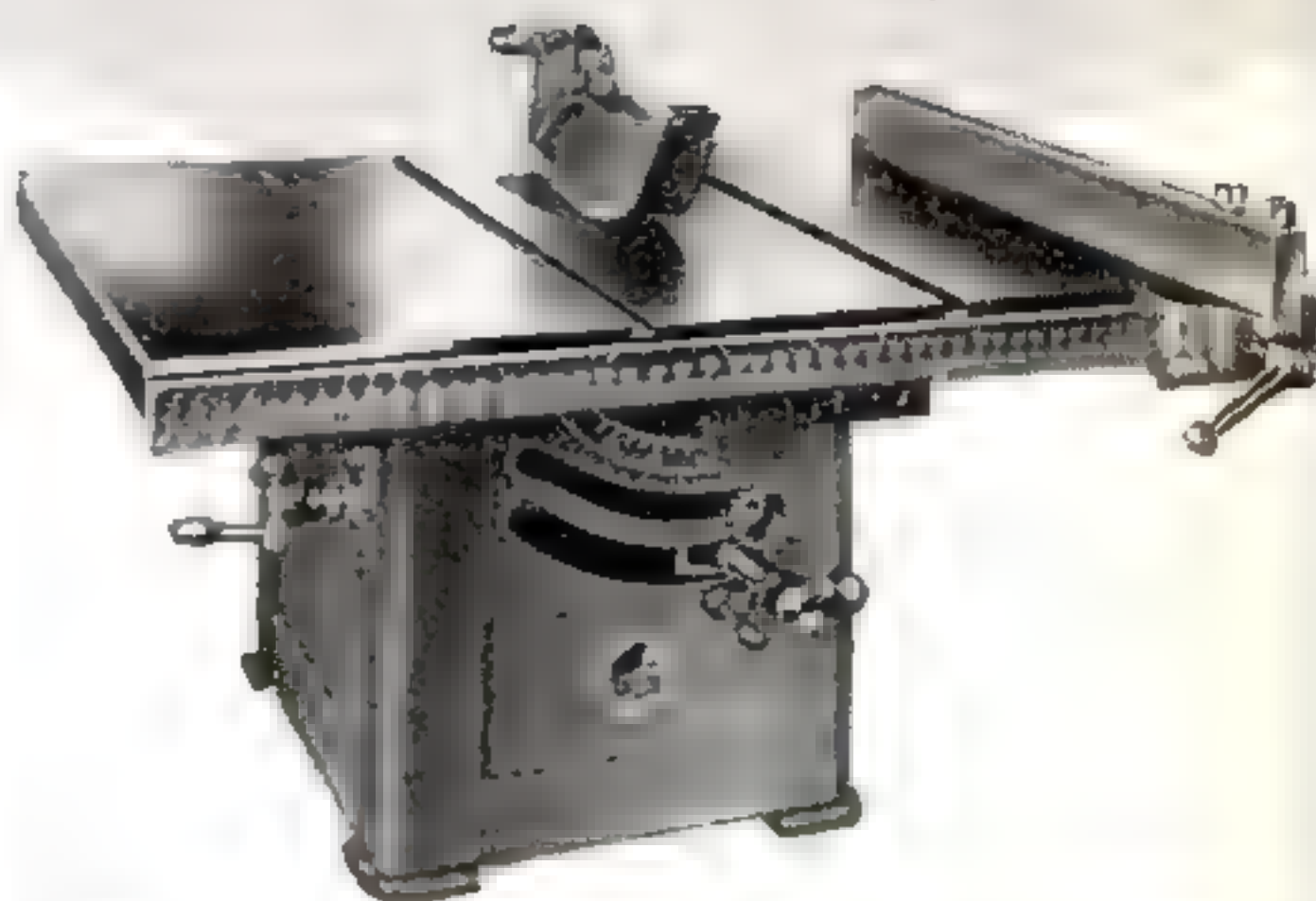
As they pulled up at the door, Gus saw Trooper Jerry Corcoran come out, a wide grin on his brown face. Gus's escort was grinning, too.

"We've had a serious complaint against you, Gus," Jerry said. "From a fellow named Joe Clark. He called up and reported that you have been loitering around his garage all morning, and asked us to see that you left town. If you know what's good for you, you'll keep right on going—all the way to the World's Fair!"

"Well," Gus said, "if that's the way the authorities feel about it, I guess maybe I will!"

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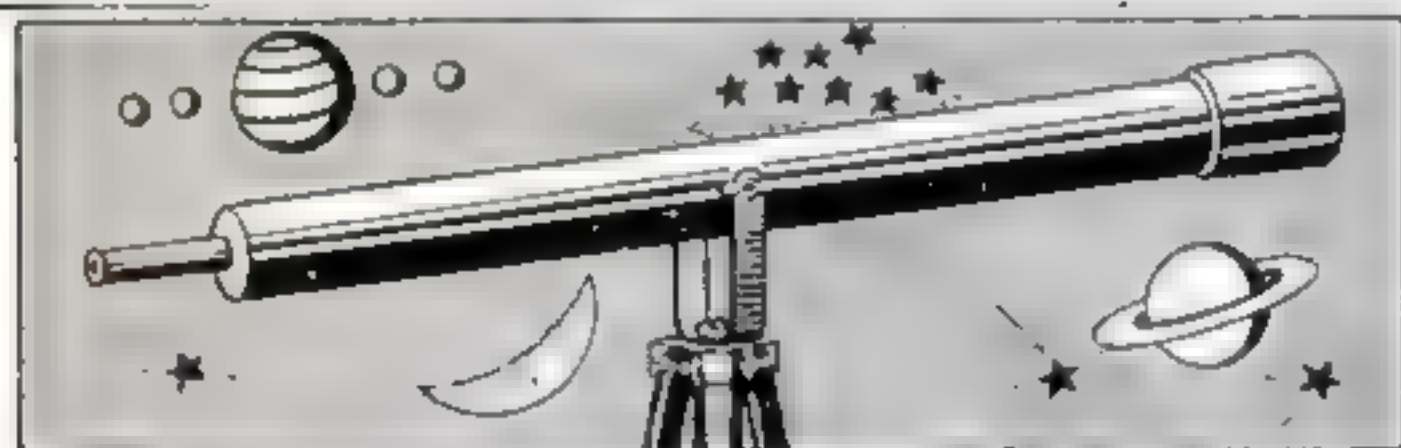
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Chemical Analysis for Amateurs

(Continued from page 205)

be tempted to watch the play of color for minutes at a time. This should not be done unless the room is well ventilated. Decomposition of the carbon tetrachloride is only partial, and poisonous phosgene gas is also produced. The experiment is perfectly safe when allowed to run for several seconds, however.

By applying the Beilstein test "in reverse," you can detect copper in alloys. First, immerse some strips of sandpaper, half an inch wide, in a solution made by dissolving about half a teaspoonful of ammonium chloride (sal ammoniac) in 100 cubic centimeters, or roughly three fluid ounces, of water. When the strips are thoroughly wet, remove them and dry them in a horizontal position.

Rub the sample of alloy to be tested upon one of the dried sandpaper strips, until a plainly visible streak of metallic particles has been left. Then hold the paper in a blue Bunsen flame, or in the flame of an alcohol lamp. If there is copper in the alloy, the yellow flame with which the paper starts to burn will quickly turn bluish-green. A nickel or a dime, both of which contain copper, will respond to this test. Steel and other metals unalloyed with copper do not produce the blue-green color effect.

In the test just described, the flame decomposes the ammonium chloride into ammonia and hydrochloric acid gases. The copper is volatilized and combines with the chlorine of the hydrochloric acid, and it is at this instant that the bluish-green hue is imparted to the flame.

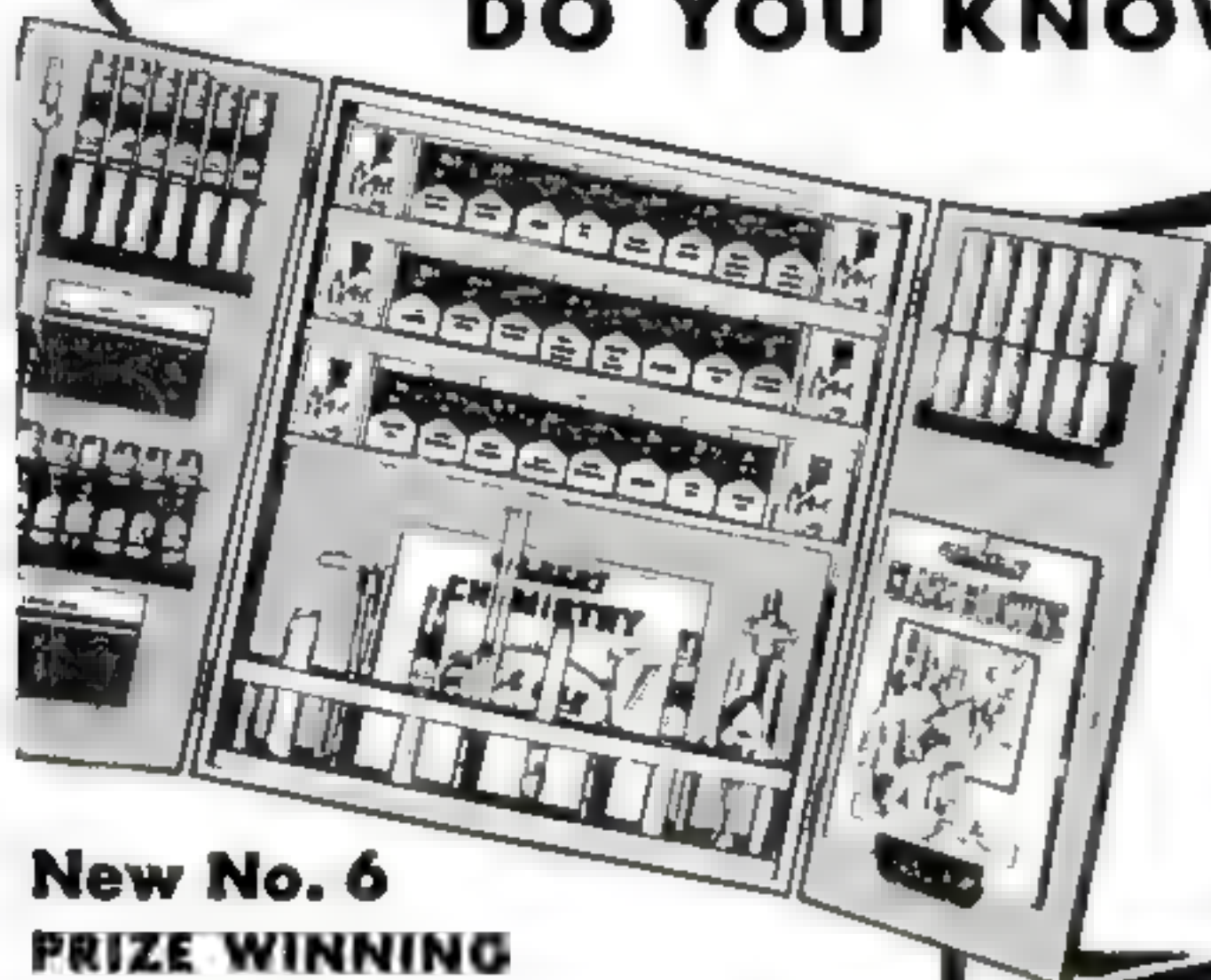
POPULAR SCIENCE Question Bee

To FIND OUT how you fared in the Question Bee on page 150, compare your results with the list below, in which letters indicate the correct answers. Give yourself five points for each one you had right. A total score of 75 to 85 is good; if you made 90 or more, you have good reason to be proud.

- | | | | | |
|------|------|-------|-------|-------|
| 1. b | 5. c | 9. a | 13. b | 17. b |
| 2. c | 6. c | 10. b | 14. a | 18. c |
| 3. c | 7. b | 11. b | 15. d | 19. b |
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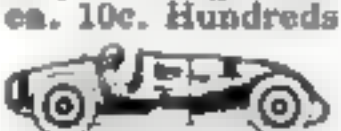
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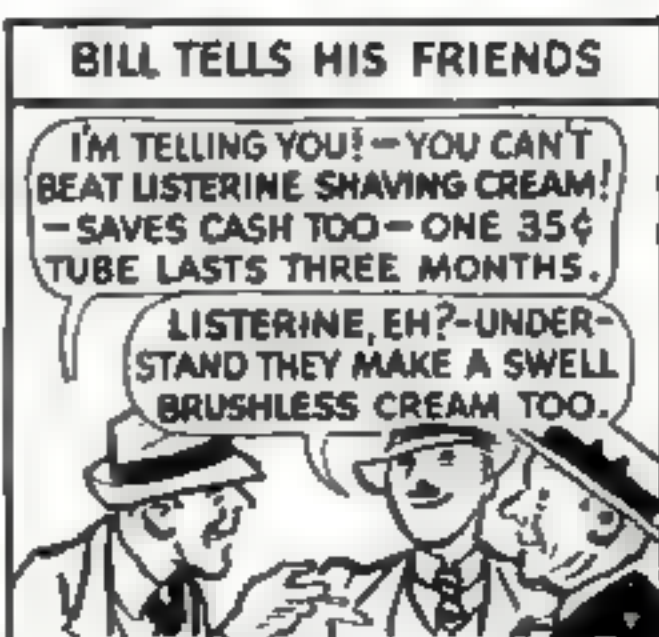
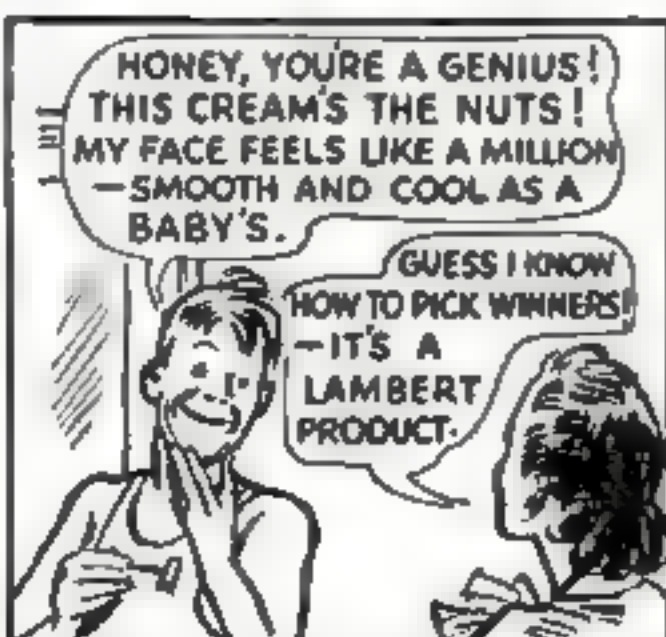


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(SEE PAGES 220 and 239)



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Microscope Questions ... and Answers

(Continued from page 209)

used for specimens that contain water or would be damaged by preparing them for balsam. Liquid petrolatum is another medium, useful for insect parts and similar specimens. Special mounting preparations having high indices of refraction are used for diatoms and other objects which are so nearly like glass that they cannot be seen easily in balsam. Black, wax-like mounting preparations are used for algæ and hairs, to make surface details easier to see.

How can I measure bacteria with my microscope?

ARRANGE the instrument as described for measuring its power, except that you may have to use a ground-glass screen in order to see the image. Be sure to maintain the 250-mm. screen-to-eyepoint distance, as this is a standard value. Measure the projected image of a bacterium and divide by the magnification of your instrument to find the actual size. For example, if you have a 10X eyepiece and a 90X oil-immersion objective, your total magnification is 900 diameters, and you would divide the measured size of the image by 900.

What is "diameter" with reference to magnifying power?

MAGNIFICATION in diameters is the linear magnification. That is, the actual distance between two points on the object being observed is made apparently so many times (diameters) greater by the lenses. At 10 diameters, a plant seed 1 mm. long looks as if it were 10 mm. long. Sometimes it is said that a microscope "has a magnification of 10,000." What is really meant is "a magnification of 100 diameters." The 10,000 is the magnification in area, and is obtained by squaring the linear magnification. When some one says that a microscope magnifies 500 times (500X), he means 500 diameters or 500 times linear.

How can I get in touch with dealers in microscopes and supplies?

GO TO a telephone office and ask to see telephone directories of the cities where dealers are likely to be found. In the classified sections you will find several firms to which you can write, stating your needs. For New York dealers, ask for the Manhattan classified directory.




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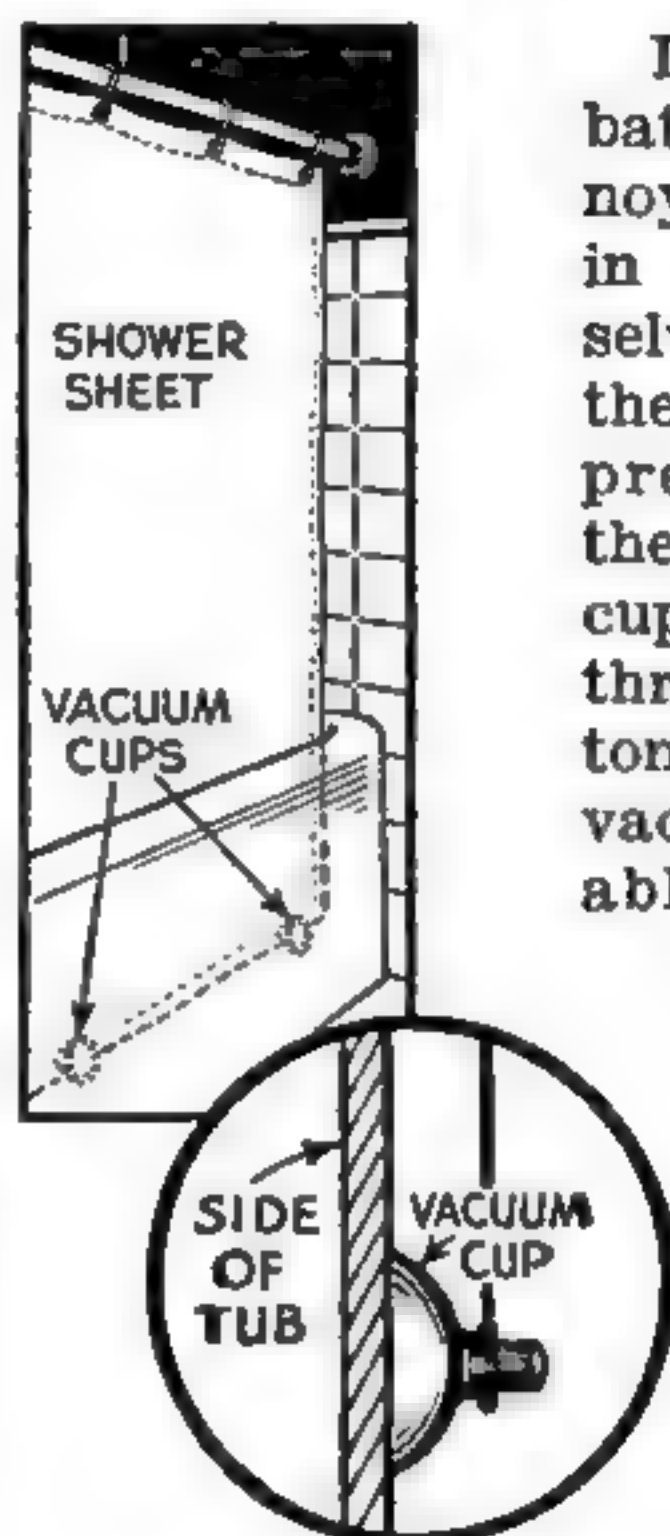
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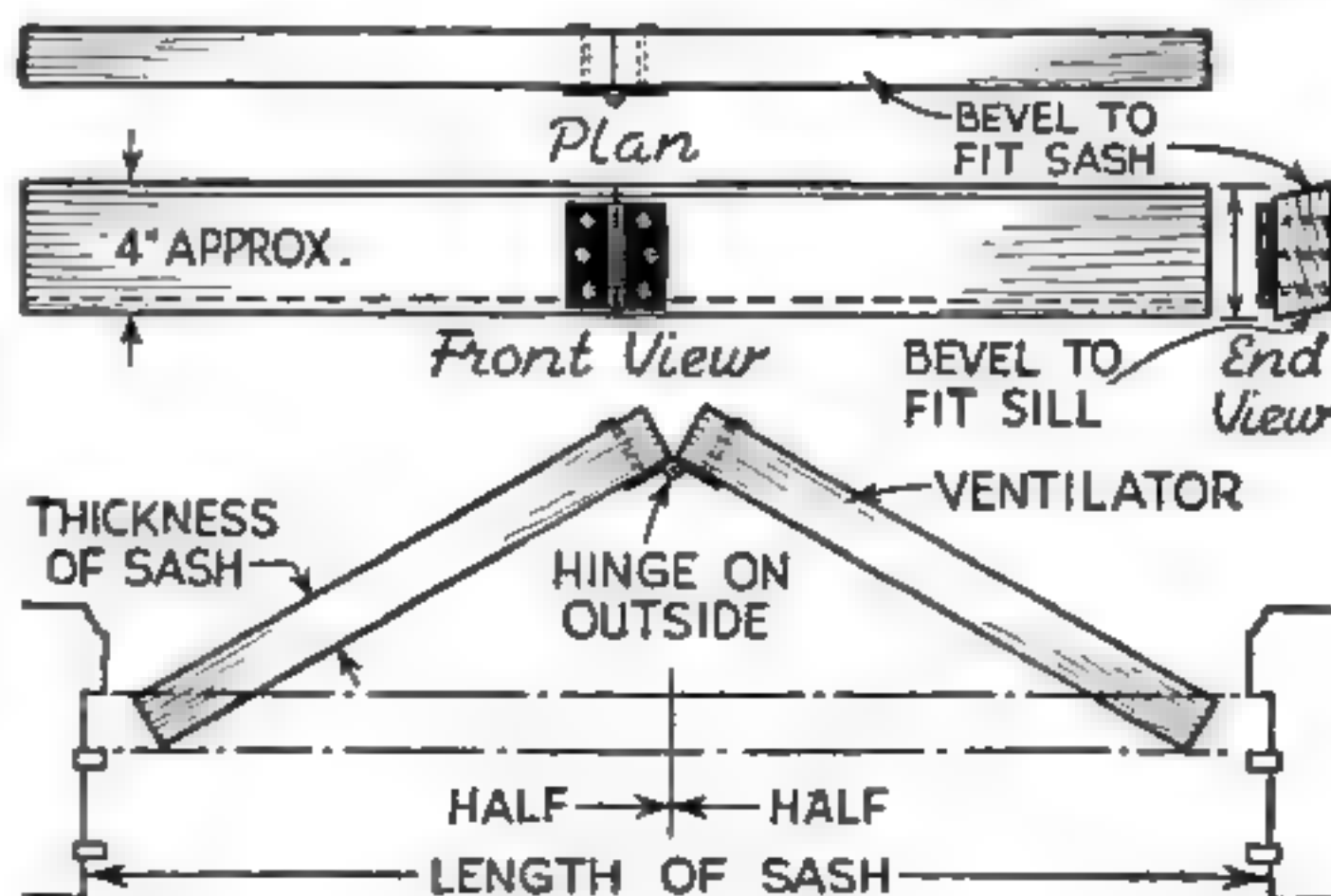
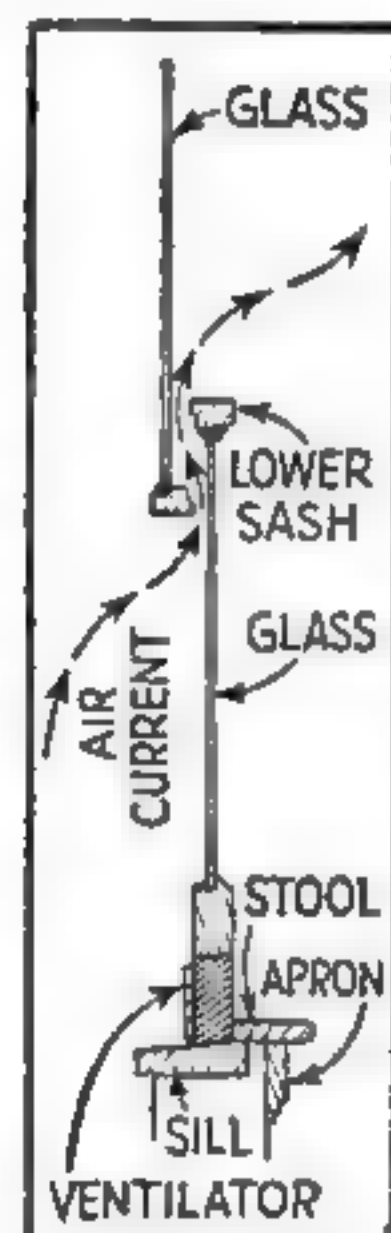
Vacuum Cups Hold Bottom of Shower-Bath Curtain



LIGHTWEIGHT shower-bath curtains have an annoying tendency to blow in and even wrap themselves around the body of the bather. This can be prevented by fastening the curtain with vacuum cups to the tub at at least three places along the bottom, as illustrated. The vacuum cups are obtainable at any stationery counter. When fastening them to the curtain, it is advisable to reinforce the holes on both sides with small pieces of adhesive tape.—J. M.

Draftless Window Ventilator for Cold, Stormy Weather

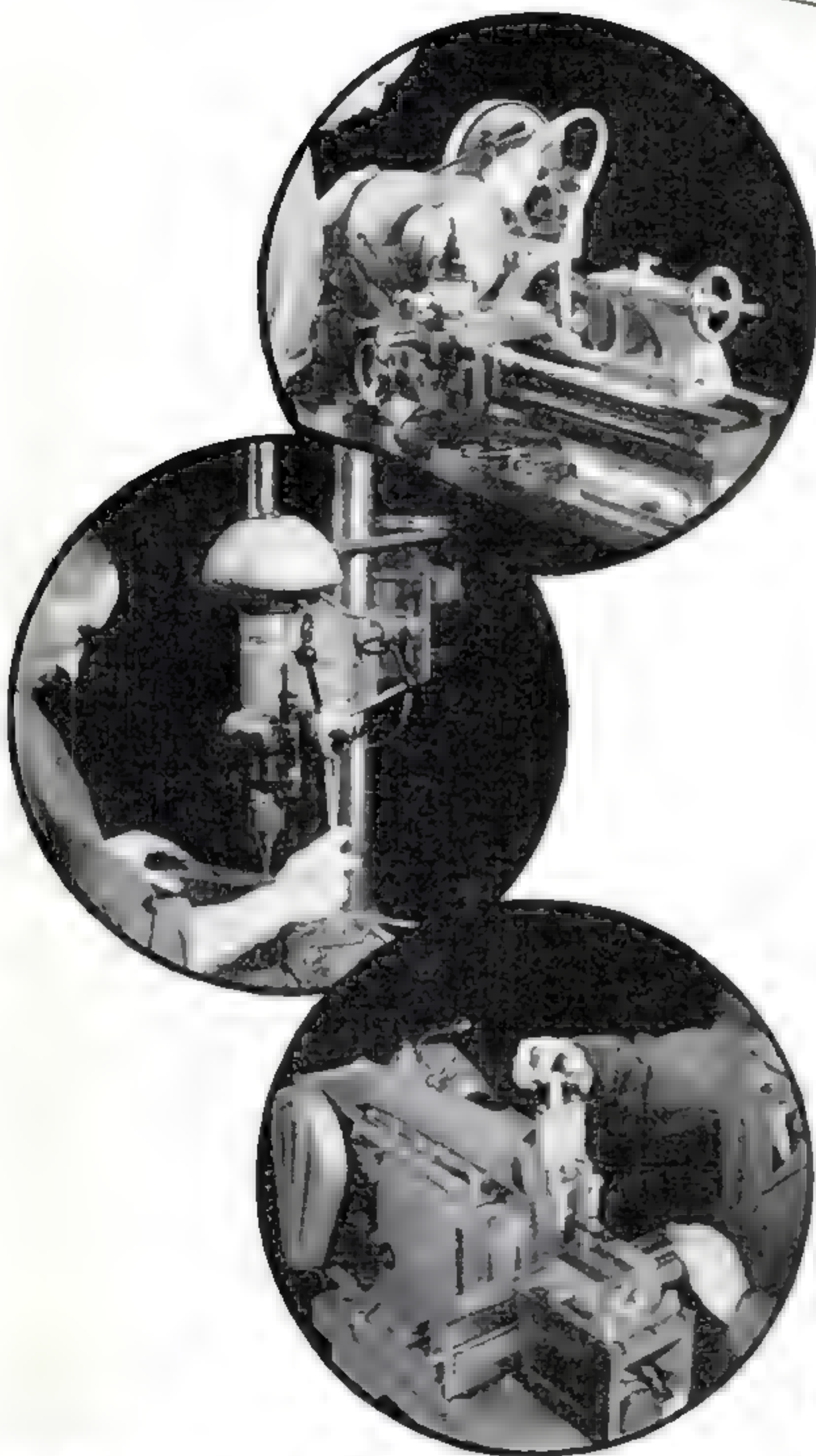
ONE of the simplest ways to provide ventilation in stormy weather is to make a hinged filler strip of wood about 4" wide to fit under the lower sash. If the window is one which must be kept securely locked, a strip of wood may be placed vertically above the lower sash at either side, or a suitable bolt or catch can be installed. In that case use long screws in attaching the hinge to the filler strip and clinch them on the inside so they cannot be removed.—H. T.



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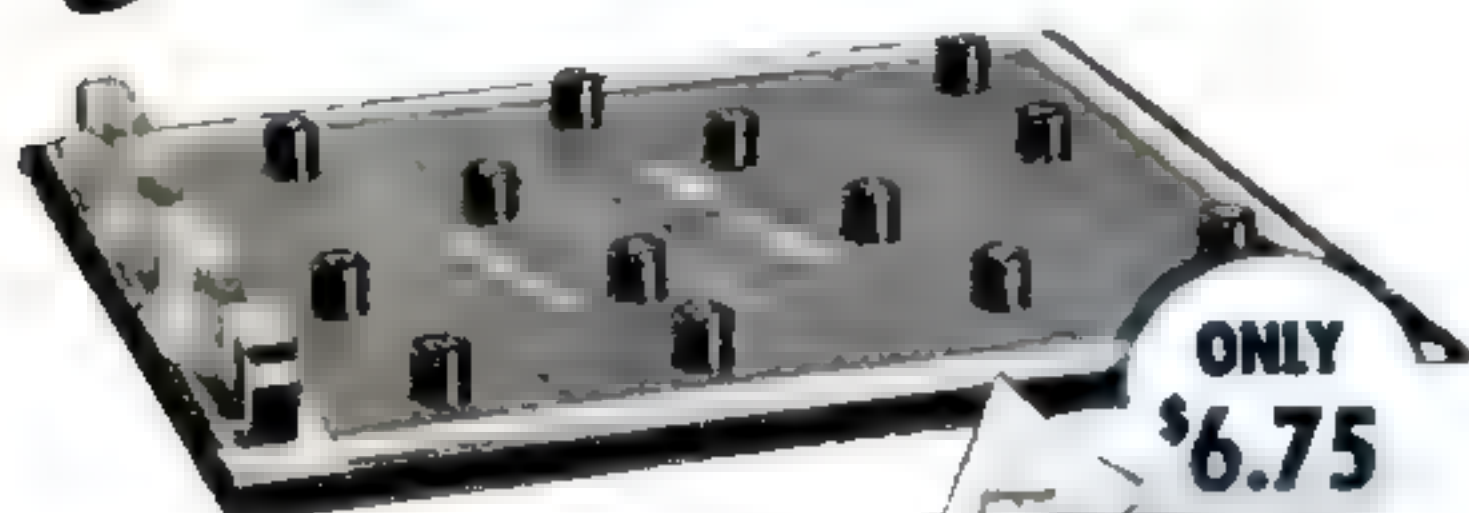
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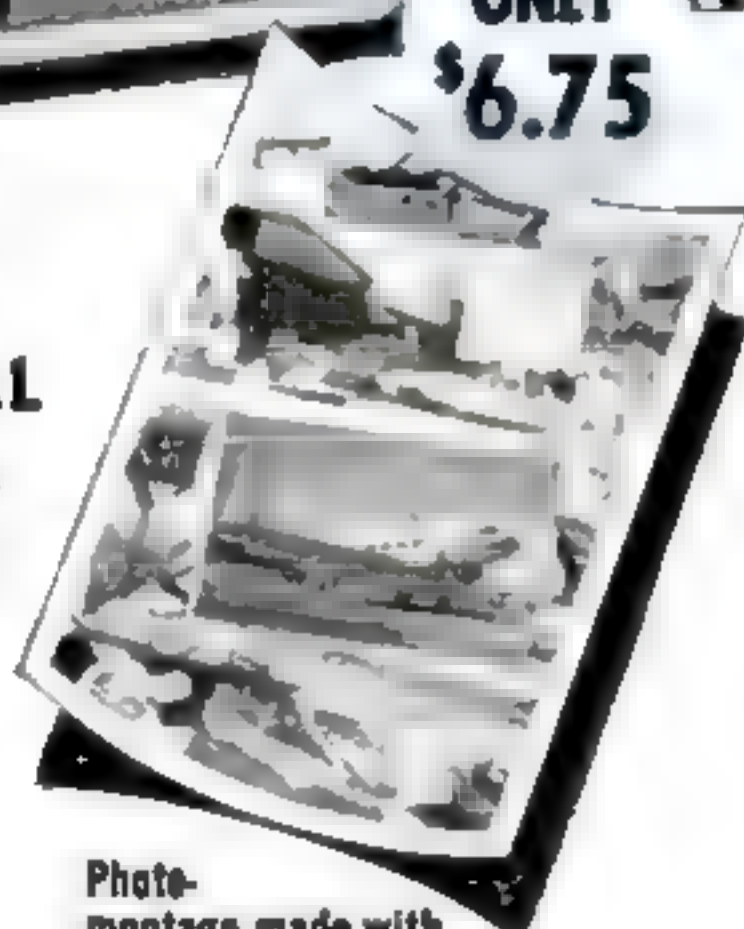
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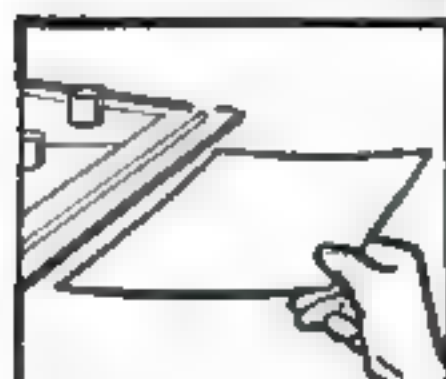
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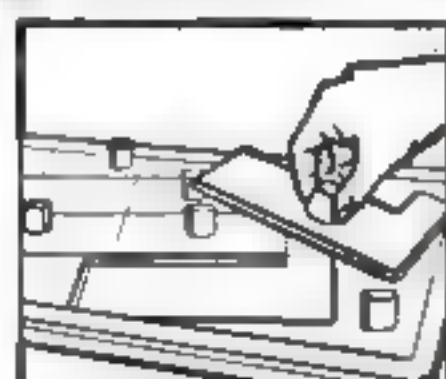
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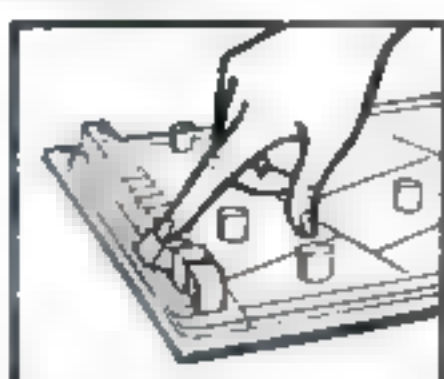
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How to Develop Cut Film in a Roll-Film Tank

MOST users of adjustable spiral-groove roll-film developing reels are not aware of the fact that these reels can also be effectively used for the development of cut films.

The only alteration required—and in some instances even this may not be necessary—is to provide a greater range of adjustment for the reel so that the reel ends can be spaced the right distance apart to accommodate the cut film. That is done by drilling a hole in the hub of the adjustable end of the reel and tapping it to receive a short 6-32 machine screw of brass or other non-corrosive metal.

The cut films are slid one after another into the groove, care being taken not to overlap them. Let the end of one film remain about an inch away from the one that preceded it in the groove. By this method the reel may also be adjusted for certain odd sizes of foreign roll films.

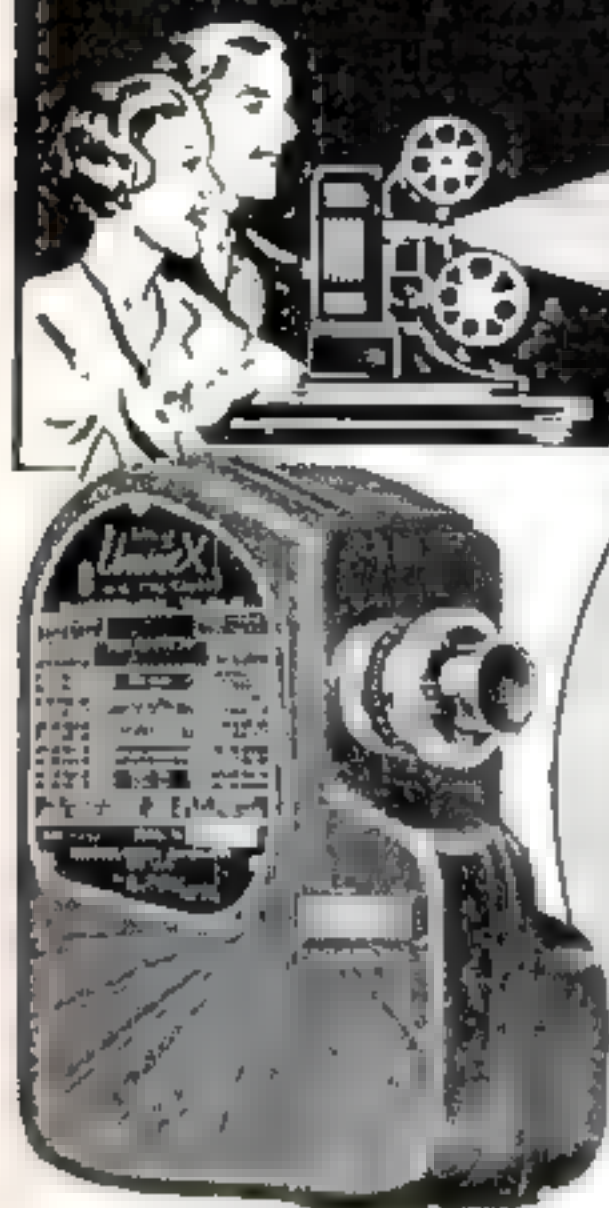


To make certain that the films do not slip and overlap during agitation, small rubber plugs may be inserted in the grooves between the films.—H. R.

Avoiding Shutter Vibration in Time Exposures

WHEN a time exposure is made and the camera is not rigidly mounted, there is danger that the picture will be slightly blurred because of the vibration of opening and closing the shutter. This can be avoided by holding a piece of dull black card over the lens, but not quite touching it. Then open the shutter, wait an instant until the camera is absolutely at rest, and remove the card quickly from in front of the lens. At the end of the exposure replace the card and close the shutter immediately.—C. W. R.

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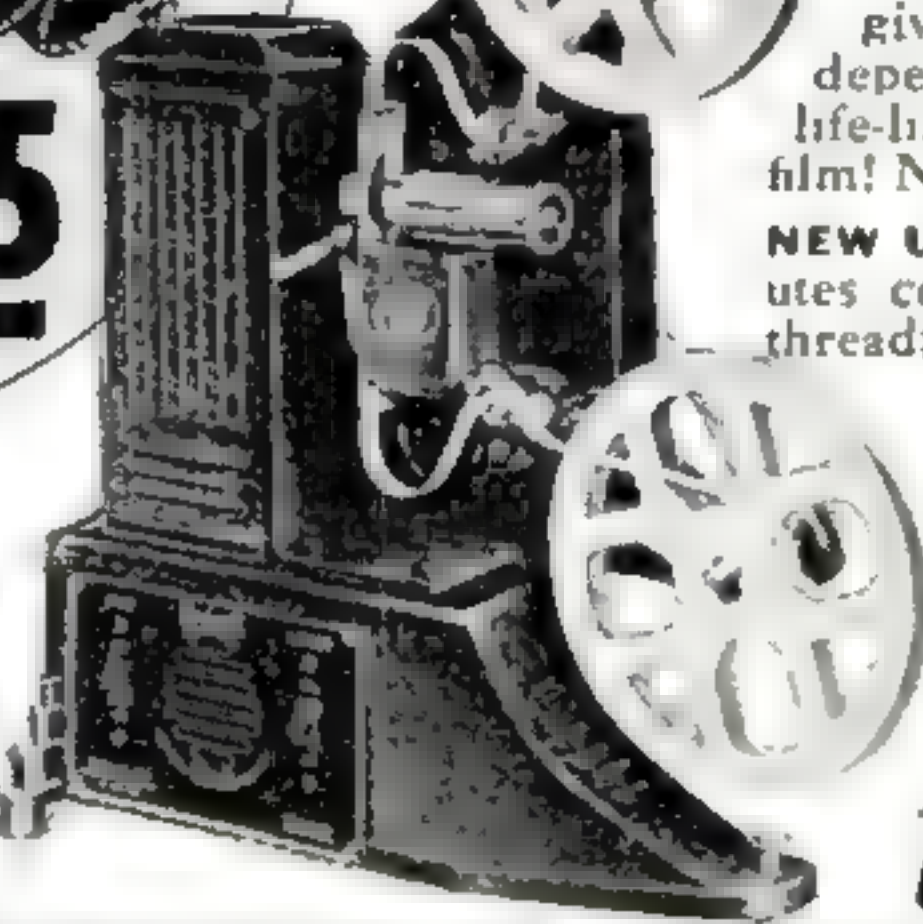
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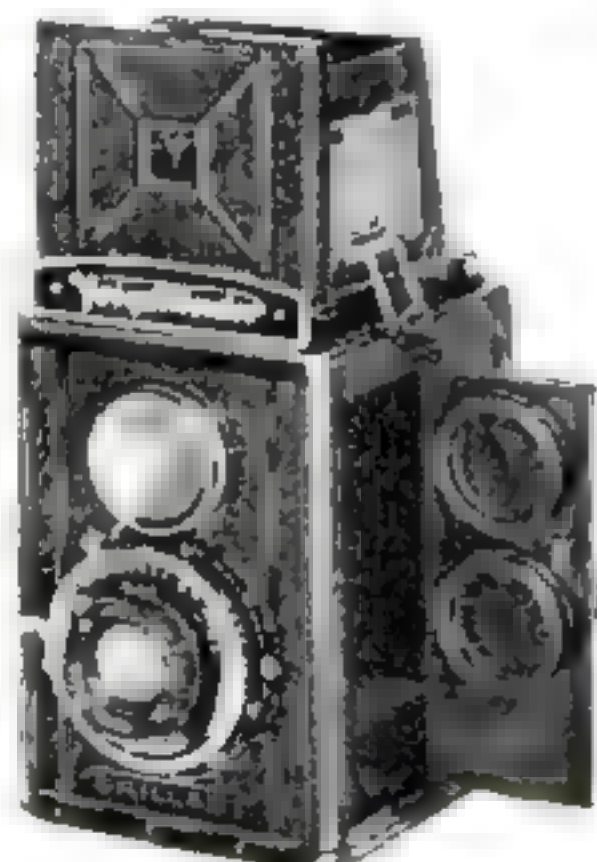
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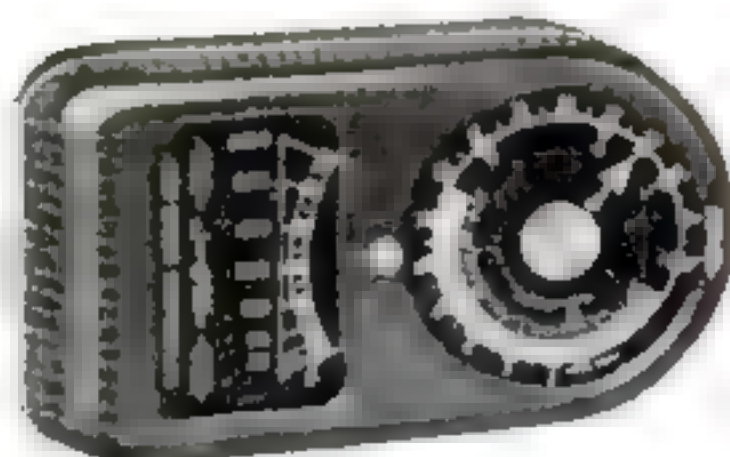
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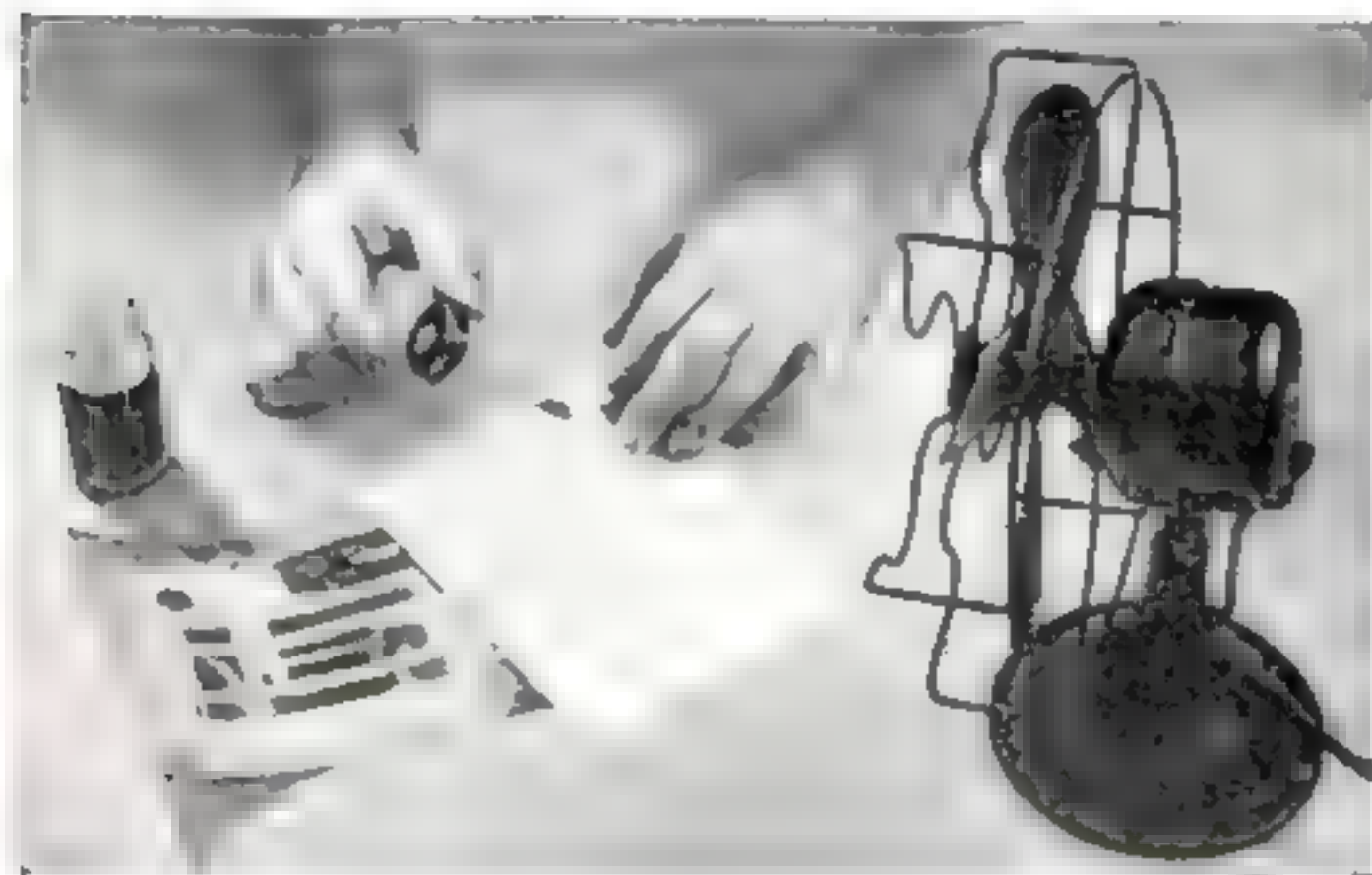
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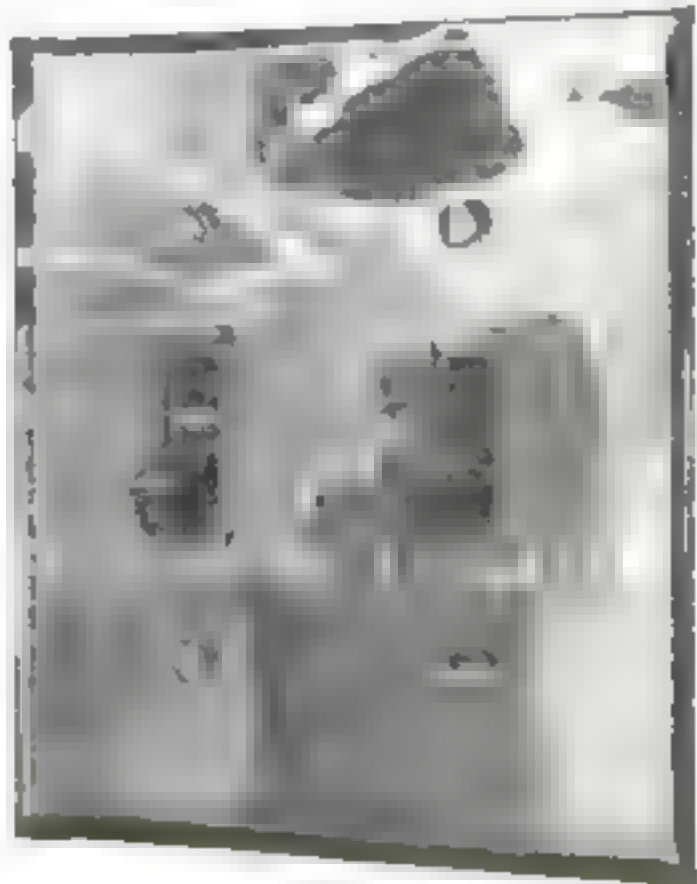
Using the breeze of a fan to speed up the drying of rubber cement on the mount for a photo print

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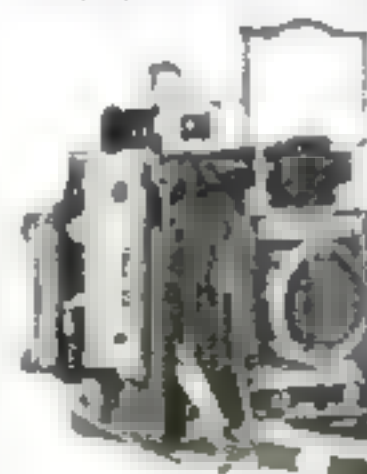


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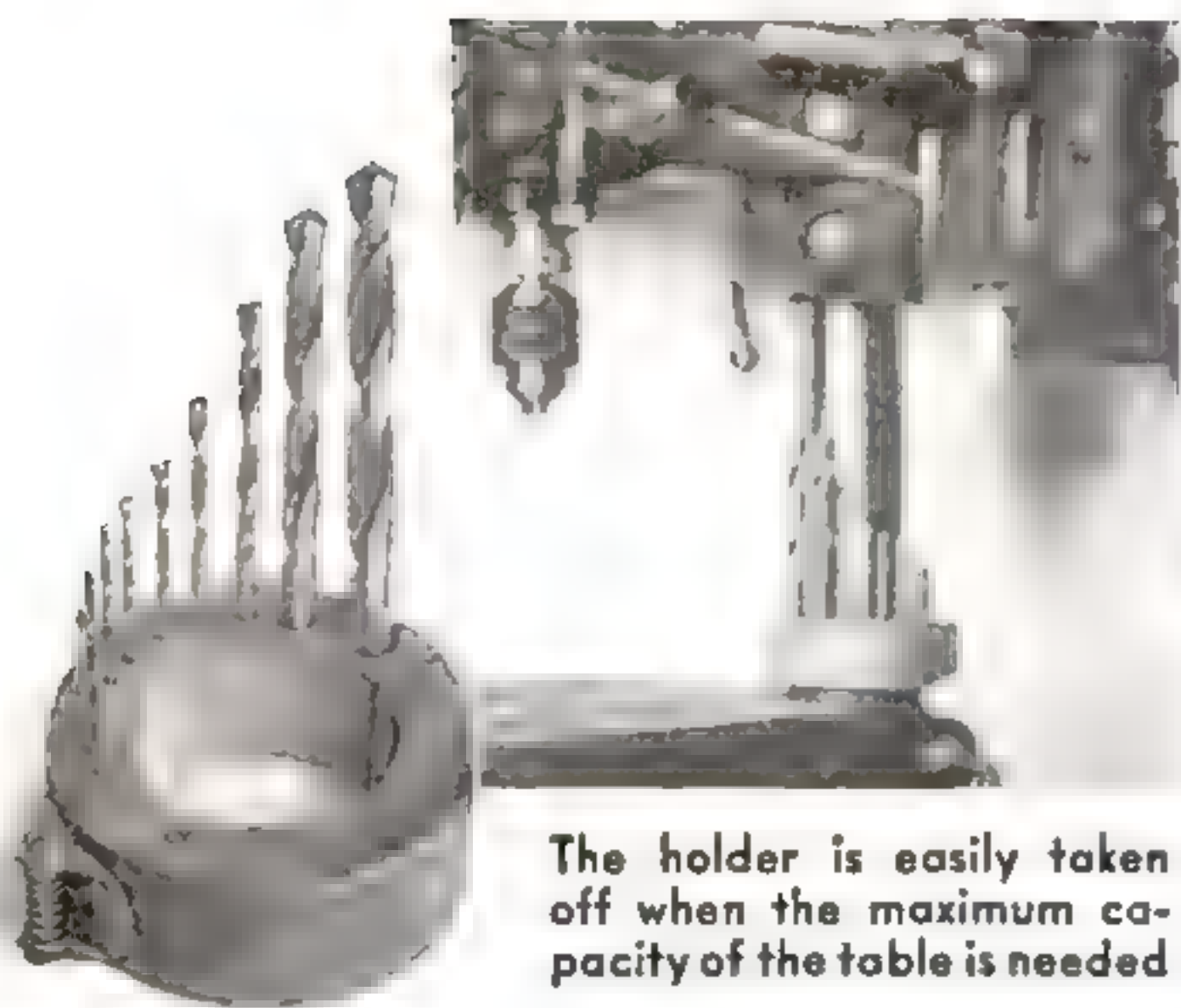


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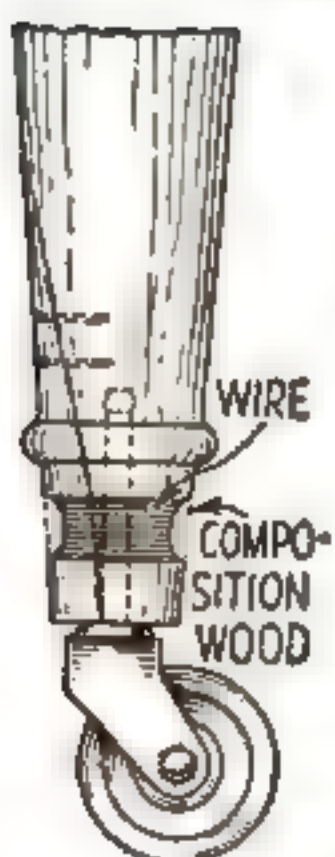


The holder is easily taken off when the maximum capacity of the table is needed

A Removable Bit Holder for the Drill Press

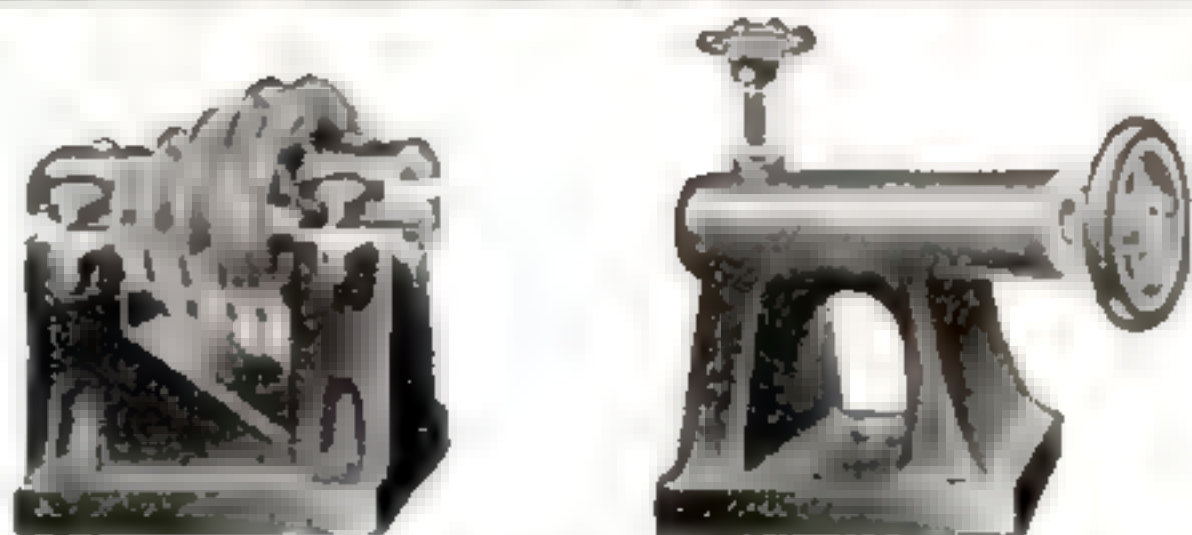
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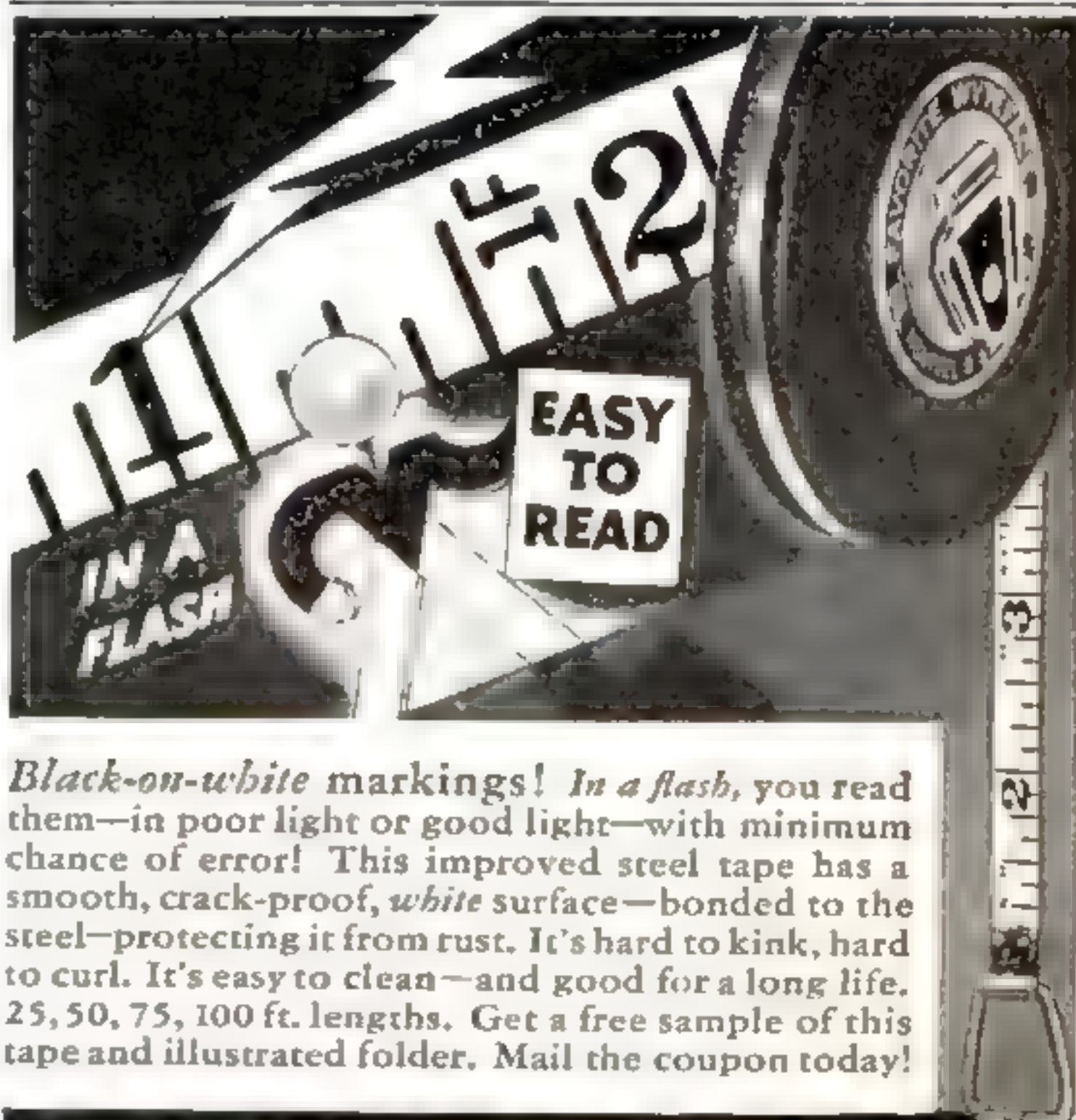
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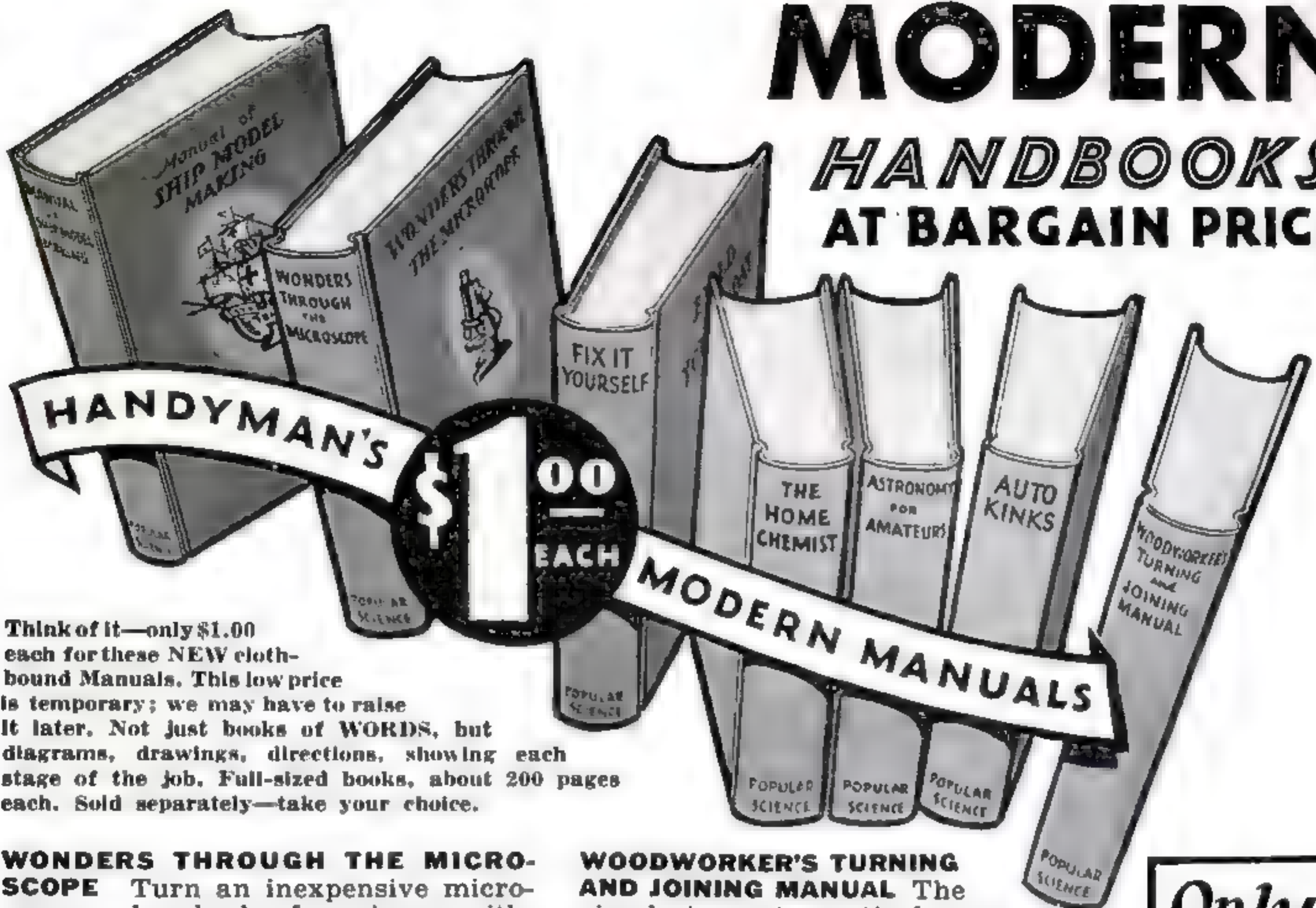
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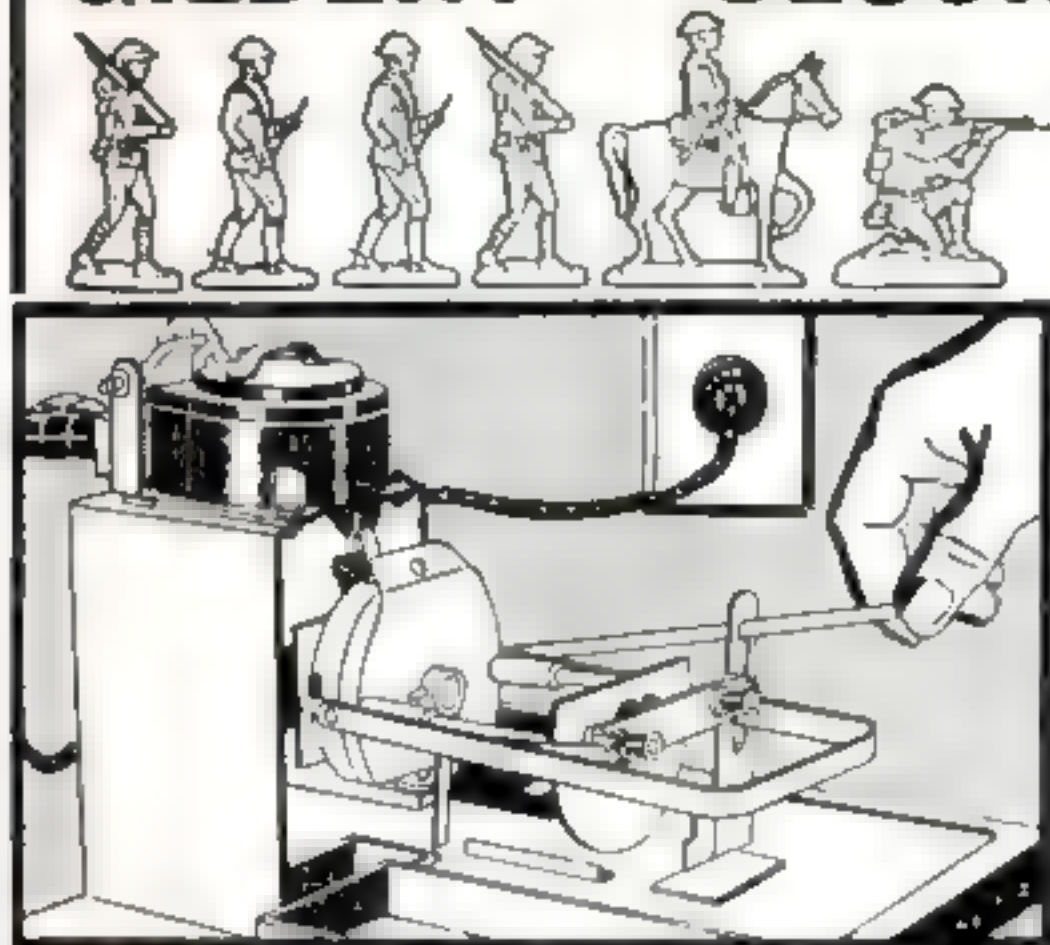
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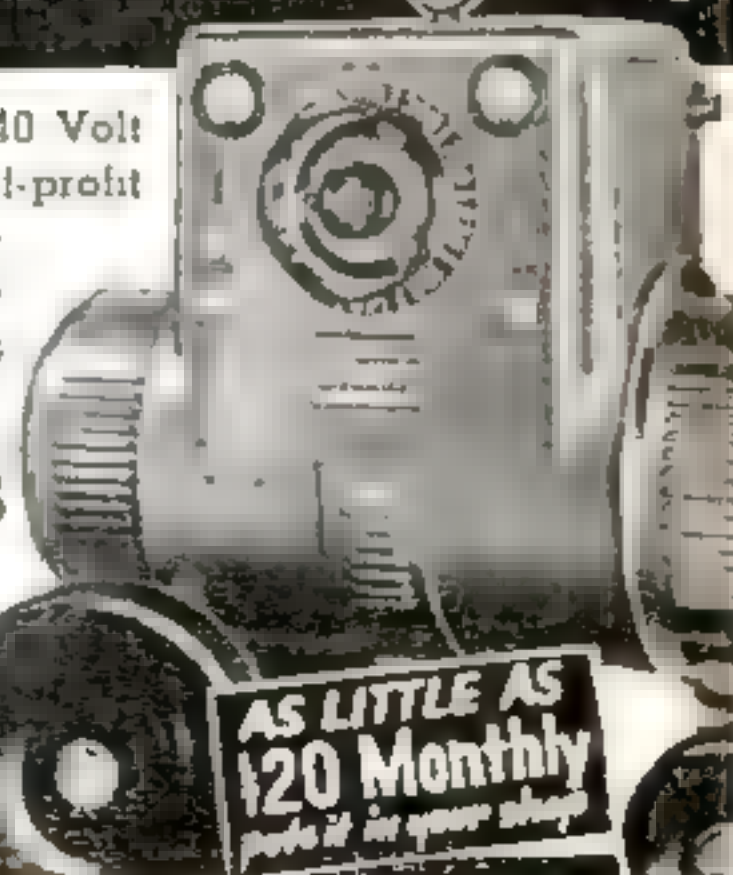
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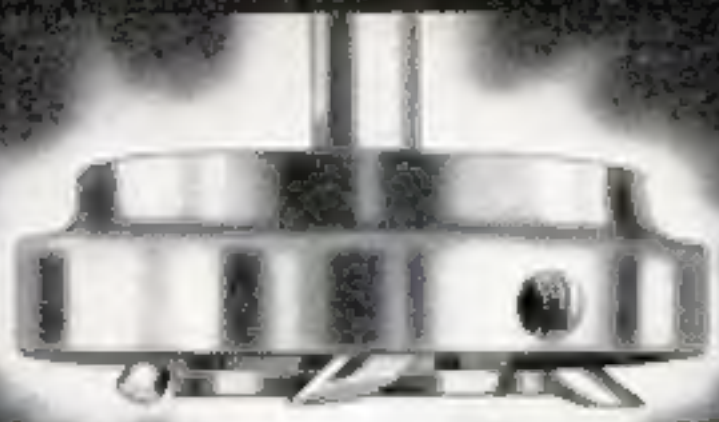


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Send today for FREE Sample and amazing profit details and bona fide reports of big steady earnings! Also, 3-way proven sure money-making plan. Get started at once on this permanent, profitable business. No competition. Simply mail name on penny post card—NOW! Be the exclusive Warner Nu-Way Electroplater in your community.

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360 N. Michigan Ave., Chicago, Ill. Dept. 2 R

**FREE
SAMPLE
PROVES
CLAIMS**



UNHEARD OF \$4.95 VALUE at

Complete with 30 piece Arbor Tool Set and Heavy Bench Stand.

The double duty electric power tool that combines the convenience of a bench grinder with the precision of a hand grinder. Use it either way, as a sturdy bench grinder, or remove the heavy cast iron base and convert it into a fine precision hand tool.

Includes 30 piece Arbor Tool Set in Selector Box, Cutters, Burrs, Arbors, Grindstones, etc., that enables you to grind, carve, sand, cut, drill or polish

with a great saving in time and effort. At this low price, order your grinder NOW. Rush \$1.00—Balance C. O. D. Fully Guaranteed.

Philadelphia Machine Co., Dept. DU, 118 N. 6th St., Phila., Pa.



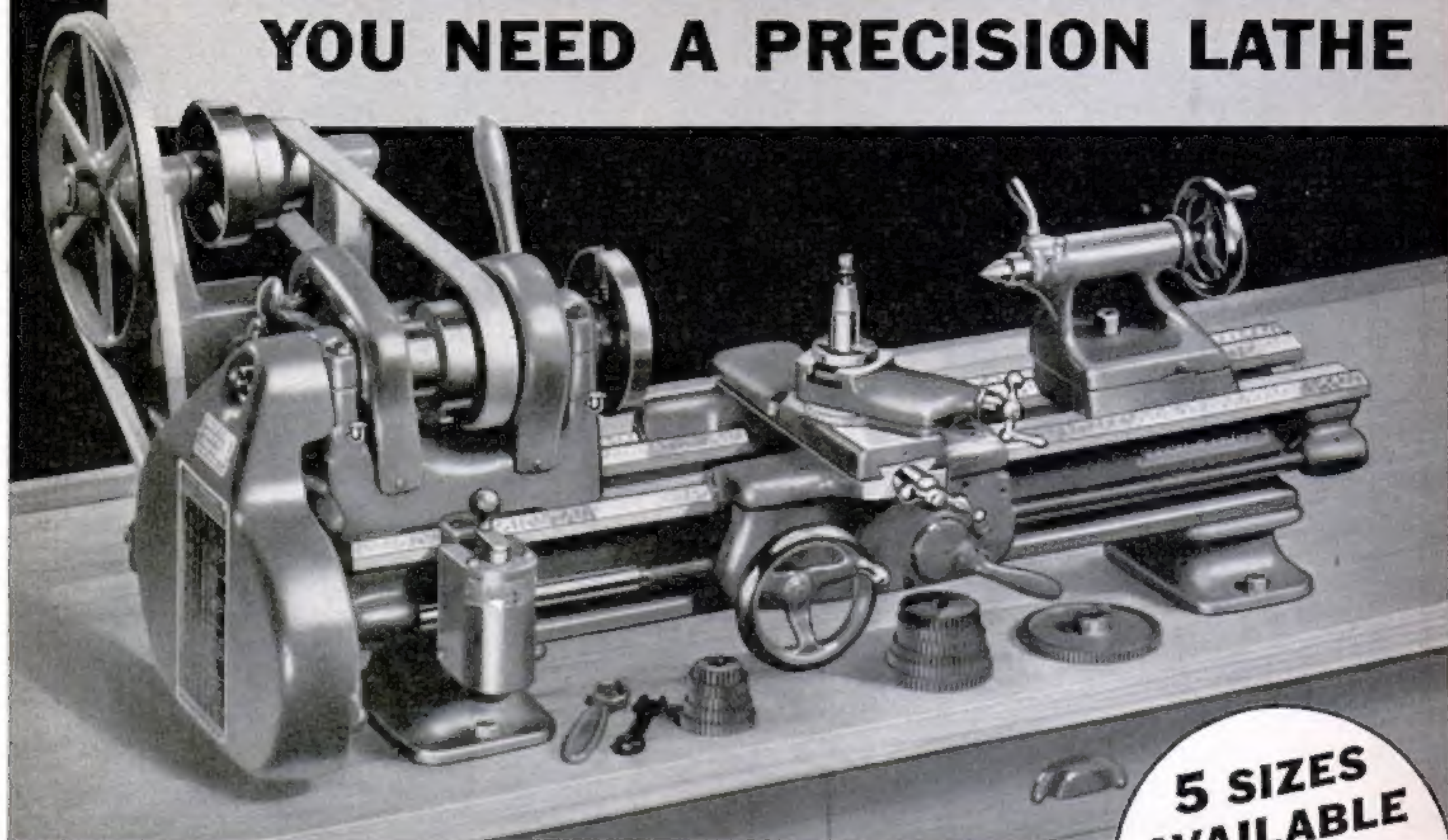
50 PIECE UNIVERSAL ARBOR TOOL SET 95c

Indispensable to Jeweler, Laboratory, Model Maker and Home Craftsman. The ideal outfit for fine accurate grinding, sanding, routing or carving. Includes 12 grind stones with brass centers in assorted sizes, 5 bakelite cut-off wheels, 5 assorted engraving, routing or carving burrs, 2 polishing buffs, 2 bristle polishing brushes, circular and cup shape, 3 mandrel arbors, 20 assorted sanding discs of emery, garnet, sand, fine, medium and coarse.

Send Coin or Money Order
Shipment Prepaid

Phila. Mach. Co., (Dept. D. U.), 118 N. Sixth St., Phila., Pa.

FOR ACCURATE WORK YOU NEED A PRECISION LATHE



No. 415-YC, 9 1/4" Swing by 3' bed Workshop Model C Bench Lathe with Motor Drive as shown. Shipping Wt. 320 lbs. (Easy Payments If Desired)

\$127

**5 SIZES
AVAILABLE**

9", 11", 13", 14 1/2"
and 16"
Swing

ONLY good shop equipment has the precision accuracy demanded in modern manufacturing plants, tool rooms, laboratories, machine shops and repair shops. South Bend Lathes are designed and built to assure this precision and to simplify the most difficult metal working jobs.

Features include: heavy semi-steel lathe bed with hand-scraped V-ways, heat treated alloy steel head-stock spindle, precision machine-cut gears, ball thrust bearing on spindle, all steel and iron construction.

A CHRISTMAS SUGGESTION

The 9" South Bend Workshop Lathe is a superb gift for any man or boy mechanically inclined. It is a tool which any shop owner will proudly exhibit to his friends.

SOUTH BEND LATHE WORKS

841 East Madison Street
South Bend, Indiana, U.S.A.

SOUTH BEND LATHE WORKS

841 E. Madison St., South Bend, Ind., U.S.A.

- ☐ No. 46-B—9" Workshop Lathe Catalog, Free
- ☐ No. 34-LB—How to Run a Lathe, 25c

Size of Lathe Interested In.....

Name.....

Address.....

City.....State.....



PRICES OF POPULAR SIZES

Size and Type of Lathe	Price Counter- shaft Drive	Price* Pedestal Motor Drive	Price* Underneath Motor Drive
9" x 3' Quick Chg. Gear	\$358	\$431	\$486
9" x 3' Q. C. G. 1" Collet	458	543	598
11" x 4' Quick Chg. Gear	466	549	625
13" x 5' Quick Chg. Gear	571	685	781
14 1/2" x 6' Qk. Chg. Gear	714	844	964
16" x 8' Quick Chg. Gear	868	998	1129

* Includes 3 phase, 60 cycle, 220 volt, A.C.
Instant Reversing Motor and Switch.

SHOP REFERENCE BOOKS

Catalog No. 46-B—Describes and prices 9" Workshop Lathe in 3', 3 1/2', 4', and 4 1/2' bed lengths. Features and Construction illustrated in detail show why this lathe gives satisfactory service.

How to Run a Lathe—Complete reference book on lathe practice and shop work shows how easy it is to operate a lathe. 128 pages, 350 illustrations. 25c postpaid.



SOUTH BEND *Precision* LATHES

FREE! WHOLESALE CATALOG OF 4000 MONEY MAKERS

Here is The Latest Craze



Sample Set 13c

No. J680—The magnetic toy that keeps old and young spellbound. Their magnetic quality makes possible endless pranks. Genuine magnets. Packed one black and one white magnetic pup in a box. Dozen \$1.35

25 Guv'nor Double Edge Blades In Safety Pack



Sample Pkg. 12c

No. H101—Fine quality blue steel double edge blades. Many claim it compares with the finest. Satisfaction guarantee with each package. Packed 25 blades in a package with a vault for used blades. Carton of 300 blades \$1.35

Men's Blue Ribbon Shaving Deal



Sample Deal 32c

No. D180—An assortment of shaving needs needed by every man. Consists of the following Blue Ribbon products: Tube dental cream, can talcum powder, bottle after shaving lotion, tube lather shaving cream, 10 double edge blades, 1 styptic pencil, all packed in a gift box. Dozen \$3.72

Wel's All Liquid Cement



No. T10—An All-purpose cement. Recommended for repairing furniture and instruments; mending crockery, and broken dishes. Cabinet makers, radio shops, shoe repair shops find this cement most practical for their work. A powerful, cold-proof and weather-proof cement that meets most needs. Satisfaction guaranteed or money back. Put up in one oz. bottles, 12 on a self selling display card. Wholesale price 1 bottle 9c doz. 98c gross \$11.25

Men's 8 Piece Kit With Sliding Fastener



No. 5M3—Consists of case with slide fastener closure. Contains: comb, nail file, tooth brush, Gillette type razor, 5 double edge blades, tube of tooth paste and tube of brushless shaving cream. Size 7" x 3 1/2" x 1 1/2". Color black. Sample Set 69c Dozen \$7.95

Mottled Acetate Clip Combs



(See our varied line of combs in our catalog.)

No. 25N2—A fine quality comb made from non-inflammable acetate. Smoothly finished. Attached clip comb. Length 6 inches. Dozen 22c Gross \$2.39

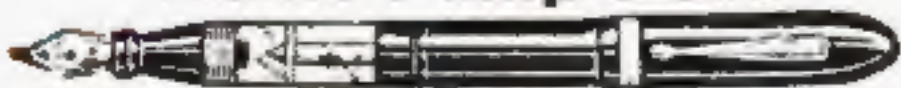
25 Xmas Folders for Photos and Complete Photo Printer Set

Your PERSONAL PHOTO ON ALL YOUR CHRISTMAS CARDS



No. D328—Prints any snapshot negative on paper, cloth or card. No extra equipment required. This can be done easily and economically. Set consists of: 25 Xmas folders with cut out picture; 3 picture masks; 1 printing frame with glass; 2 wood clamps; supply of Hypo to make pictures permanent; 1 bottle of Foto Printer fluid, enough for 150 pictures. Complete instructions with each set. Fast seller to drug, department or variety stores, also direct to the consumer. Weight each 17 oz. Sample Set 35c Dozen \$3.95

Drexel Pump Pens



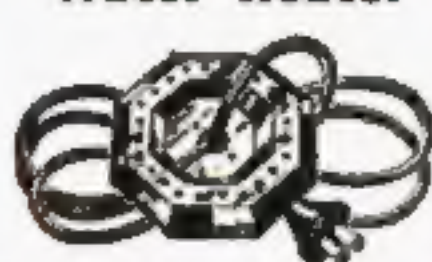
No. R303—Noted for their dependable service. Pen fitted with the smooth writing, Drexel non-tarnishing point; transparent window shows the ink level; pump filler. Acclaimed by many to compare with the finest. Five year service guarantee with each pen. Beautiful jet black color. Sample 20c Dozen \$1.75 Gross \$19.90 (See our large variety of pens and pencils shown in our wholesale catalog.)

Fad Wrist Watch



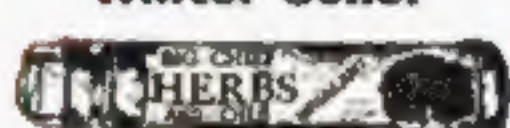
No. V301 1/2—Fine quality. Tonneau shaped, chromium finished case. Unbreakable crystal. Three year service guarantee with each watch. Any Quantity \$1.49 Each

Water Heater



No. E541 1/2—Heats water from light socket. Ideal for cottages, cabins, stoves, homes, offices, etc. Operates on 110 A.C. or D.C. Each in a box with instructions. Sample 75c Dozen 69c ea.

A Fast Fall and Winter Seller



No. T123—Herb and Oil Inhalant. Recommended for discomforts caused by colds, sinus trouble, headaches from colds, etc. The fumes from the inhalant do the trick. Satisfaction guaranteed or money back. Dozen 98c Gross \$9.96

Tie and Collar Holder Set



No. V82—Nickel finish. Tie holder has pearl effect and assorted nickel finish ornament. Each set in a box. A wonderful value. Doz. Sets 40c Gr. \$4.50

Pocket Magnifier and Compass



No. V3—A standard magnifying lens, 7/8" diameter, set in brass mounting; nickel plated 1/2" compass. Desired by Boy Scouts and Camp Fire Girls. Sample 8c Dozen 75c Gross \$8.75

Automatic Wind-Proof Lighter

No. M91—Attractively designed nicked lighter. Simply press side, top will open and light. Perforated chimney helps to prevent wind from blowing out the flame. Sample 29c Dozen \$2.95



Coin Purse Dispenser

No. M198 1/2—Helps to keep change at the finger tips. Change kept in separate rows for ready accessibility. Capacity—8 quarters, 15 dimes, 12 pennies, 8 nickels; also compartment for bills. Can be carried in pocket or purse or worn on belt. Size closed 2 1/2" x 3 1/2". Sample 19c Dozen \$1.98



Elgin Dry Shaver 47c each gr. lots

No. 2H8 1/2—Has self-sharpening cutter, precision head, vibrator-type motor. Constructed to give long service. Operates on 110 A.C. (Not connected with Elgin Watch Co.) Sample 55c Dozen 50c each



Zipper Billfold with Change Pocket and 5 Passes

No. M368—Genuine embossed, two-tone leather billfold. Has compartments for bills, change, cards and compartment for 4 other passes. Length closed 4 1/2". Suggested Selling Price 75c Sample 35c Dozen \$3.90



Concentrated Windsor Perfume

No. 3T4—A high quality concentrated perfume put up in 1/2 oz. imitation cut glass, half moon shaped bottle with imitation pearl top cap. Packed in telescope style box. Odors: Oriental, gardenia or bouquet. Sample 35c Dozen \$3.25



Oh-U. Scotty Mechanical Dog

No. 5J5 1/2—When spring is wound and released—the dog nods its head, wags its tail and moves about in realistic action. Dozen 77c Gross \$8.45 No. J3 1/2—Bucking donkey toy. Covered with grey fuzzy material to resemble donkey hair. Jumps around in realistic action. Height 2 3/4". Dozen 79c Gross \$8.85



Zipper Money Pocket Belt

No. C146—Concealed compartment with zipper on under side is large enough to hold several bills. Made of bridge leather. Sizes: 28 to 46. Color: Black. Sample 69c Dozen \$7.92



Falcon Jr. Folding Camera

No. V124—Takes sparkling clear pictures. Vest pocket size, uses standard 8 exposure roll films. Picture size 1 5/8" x 2 1/8". Lens is standard type Meniscus. Contains indicator for choice of instantaneous or time exposure action. Neillite case finished in a range of attractive colors. Wholesale Price \$1.18



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